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CONTENTS

COVER: Winter logging near Olney, Montana. *Photo courtesy Caterpiller Tractor Co.*

Stocking, Normality, and Measurement of Stand Density ..... *C. Allen Bickford*, et al. 99

Forestry Education in Northern Europe ..... *John A. Zivnuska* 105

Statistics from Schools of Forestry for 1956: Degrees Granted and Enrollments ..... *Gordon D. Marckworth* 115

Collection, Shipping, and Storage of Slash and Loblolly Pine Cuttings ..... *Thomas O. Perry* and *Wang, Chi-Wu* 122

Some Economic Characteristics of the Pacific Coast Softwood Plywood Industry ..... *Thomas A. Petit* 124

Effects of Glaze on the Development of Appalachian Hardwoods ..... *K. L. Carvell, E. H. Tryon* and *R. P. True* 130

Effects of Prescribed Burning in Ponderosa Pine ..... *Harold Weaver* 133

The Forest Products Research Society ..... *Frank J. Rovsek* 139

Notes 142

An Improved Method for Estimating Quality in Standing Trees; The Key to Effective Basal Spraying of Woody Plants: Wet The Root Collar; FAO Panel On Education Organized; Indications of Linear Dependence of D.O.B. Increases on D.I.B. Increases in Loblolly Pine at 17.3 Feet; Growth of Planted Slash Pine Air-Layers.

Reviews 147

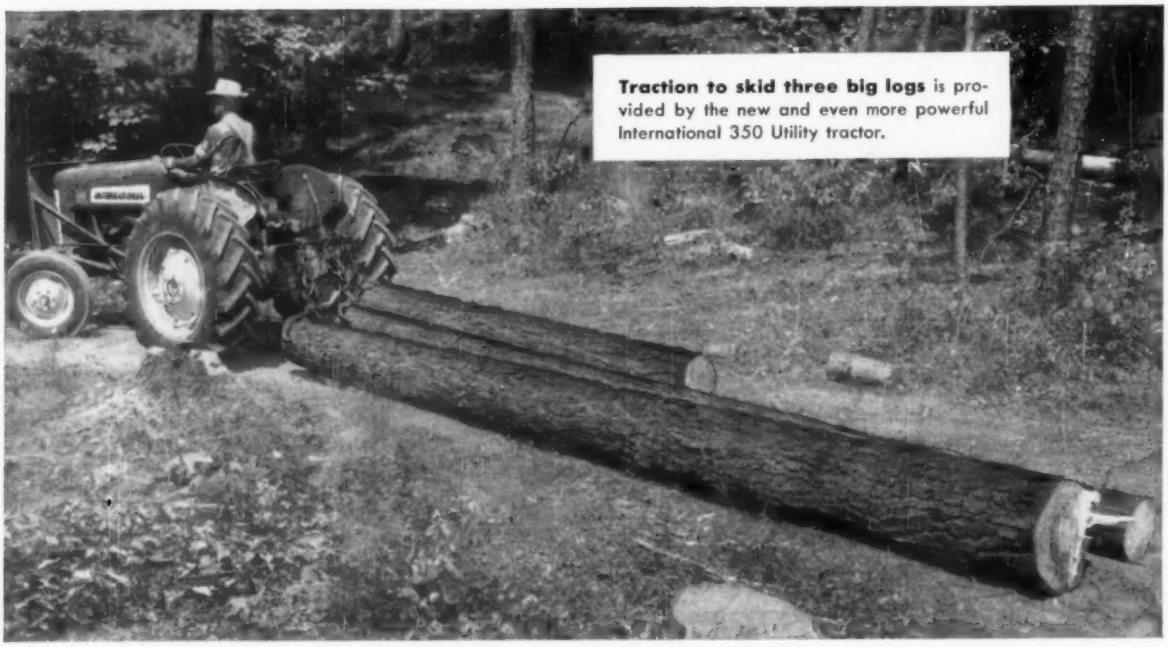
Experimental Design; Forest Practices Developments in the United States 1940 to 1955; Conserving American Resources; Dendroclimatic Changes in Semiarid America; Common Exotic Trees of South Florida; Wildlife Law Enforcement; The Horseshoe Properties Forest Management Demonstration; Publications of Interest.

Current Literature 151

Society Affairs 153

Forestry News 168

Index to Advertisers 176



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Journal of Forestry

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Stocking, Normality, and Measurement of Stand Density

C. Allen Bickford, et al.[1]

At the 1947 meeting of the Society of American Foresters, the Division of Silviculture established a Committee on Technical Procedures and Standards. Subcommittees were set up to supplement this work, including one on stocking. This is the report of the Committee on Stocking.

ONE unfamiliar with the problems of measuring stocking might marvel that a committee could exist for 8 years and do anything without producing a definitive report. The subject of stocking, however, is deceptively complex. Facts are not easily ascertained and much published material is based on intuition and shrewd guess. The subject was undertaken as being in the field of silviculture, but economics and forest management are also vitally concerned.

The concept of stocking is basically descriptive, but it should also explain to some degree as well. Counting leaves on a tree, for example, becomes tedious even if it is accurately descriptive. The exact number is less significant than the role of leaves in tree physiology and the effects of variation in number. In like manner, stocking is significant as it affects growth and yield in amount and kind.

Objectives

Our objectives in preparing this report were to: (1) examine existing concepts of stocking; (2) review the various measures of density and stocking; (3) appraise the usefulness of each in current practice; (4) urge the research needed to more fully define and describe the basic relations of stocking in stand development; and (5) encourage the development and use of better measures of stocking and stand density.

Needed Definitions

Before going further, we should say what we mean by stocking. *Forestry Terminology*, 1950 edition, (*27*) defines stocking as: ". . . an indication of the number of trees in a stand as compared to the desirable number for best growth and management: such as well-stocked, over-stocked, partly stocked." Earlier (*26*), stocking was synonymous with stand density, now defined as "density sity of stocking in terms of number of trees, basal area, volume, or other criteria, on a per acre basis."

Former interchangeable use of stocking and density has resulted in much unnecessary confusion. The present distinction is clear: stand density is expressed numerically on a per-acre basis while stocking is relative to the stand desired for best growth. Consistent use of these terms, recognizing this distinction, should promote clearer thinking for all of us.

As stocking depends on best growth, we need to be clear about that too. Growth is referred to increment (*27*), which is defined as: ". . . increase in diameter, basal area, height, volume, quality, or value of individual trees or stands in relation to time." "Desirable number of trees for best growth and management" will vary with many factors such as tree size, unit of measurement, species, markets, and quality. It is evident there may be several criteria of best and several points of reference for evaluating stocking.

The Concept of Stocking

Thus it is evident that stocking is a loose term at best. It has been used in many senses: for adjusting a yield table to estimate current increment, as a correction factor in volume estimation, for identifying the need for silvicultural treatment, or for expressing relative occupation or utilization of an area. There are also varying shades of meaning as the term is used in silviculture, management, and economies. Confusion in the use and interpretation of stocking should not be surprising.

Results of variation in stocking are usually evident. An understocked stand does not fully utilize the site. Trees in such a stand are characterized by excessive taper, coarse branches, and a high live-crown ratio. A rank undergrowth of shrubs and small trees is another common result. Overstocking, on the other hand, results in trees of little taper, few slender branches, a low live-crown ratio, an accumulation of raw humus, and little or no undergrowth. In these overstocked stands, dead trees are common. Thus the end result of either under- or overstocking is to reduce net volume increment. But form and product quality are usually better in trees grown in well- to overstocked stands.

In silviculture, stocking partially describes the environment within which the trees of a stand are growing. Trees behave differently as individuals in open stands as compared to dense stands, and so they record the history of past

[1]Prepared by the Committee on Stocking, Division of Silviculture, Society of American Foresters. Membership: F. S. Baker, Fred G. Wilson, C. Allen Bickford, *chairman*.

The Committee gratefully acknowledges the contributions made by former members of the Committee: P. A. Briegleb, Henry Bull, and Bert Lexen.

density and often give an indication of present stocking. Thus it is a guide to silvicultural treatment; for example, choosing which measure to apply and when to do it.

In forest management, manipulation of stocking may eventually permit the manager to lengthen or shorten his rotation, favor desired species, and maximize the yield of selected products. Too often at present he is confronted with an old-growth forest that carries too much volume in overaged trees, or with a deteriorated younger forest that is inferior in composition, form, or condition. It is relatively easy to prescribe better practices; but profit margins may be small and the forest manager may have to work gradually towards the highly productive forest that allows manipulation of stocking.

The forest economist is interested in stocking as it affects invested capital. He would like to define optimum stocking on the basis of marginal yield (*6*). His concept of stocking is quite different in emphasis from that of the silviculturist or forest manager, however. It is more general and abstract, is concerned with alternative investment, and applies to an entire property rather than to individual stands.

It seems likely, however, that more foresters think of stocking in relation to best growth than in any other sense. The terms over-stocking and under-stocking recognize upper and lower limits for best growth. From these limits, it is natural to infer an optimum level of growing stock that results in maximum volume increment. If it were possible to identify this optimum level we would have a goal to strive for as regards growing stock.

Many studies have been directed at the problem of growth and increment in relation to stocking. Meyer (*18*) has pointed out that unit of measurement affected relative yield of Douglas-fir. More recently, another study has shown that maximum growth in relation to stocking varies with the unit of measurement (*31*). In still another study, biological growth was unaffected by considerable variation in density, but product value was profoundly affected (*1*).

Accretion, on the other hand, was found to be strongly correlated with density (*2*). It is helpful to separate the components of growth, especially in many-aged stands. A stand changes as accretion is added to previously measured trees, as ingrowth results from recruitment into measurable size, and as trees are cut or die. Combining these elements into net or gross growth obscures basic relations and may explain the poor correlations that are often found.

Stocking in relation to an ideal.—It is evident that the stand desired for best growth is an ideal that the forest manager tries to attain. In the specification of such an ideal, two aproaches are possible: (1) the capacity of an area to support trees and (2) the stocking that results in maximum yield. The two are not the same and may be unrelated. The first is measured by relative occupation of an area, with appropriate adjustment for mixture by species and ages. The latter is that best stocking which every forest manager would like to have if he only knew what it was and could recognize it if he saw it. Our definition of stocking accepts the second approach because it is relative to best growth rather than site occupation.

The first approach is older and better established. And it is more easily recognized on the ground, particularly in even-aged stands of relatively uniform sized trees. The philosophy of this viewpoint as an expression of the past is well developed by Meyer (*18*) with reference to even-aged Douglas-fir. As it only measures what has taken place in the past, it is not well related to future development under forest management. Something less than full occupation of a site results in a growing stock of thrifty and vigorous trees that maximize production on that site.

The second alternative, the stocking that would result in maximum yield, is far more valuable. But it is also far more complex: ideal stocking cannot be narrowly standardized, and we feel the lack of a reliable point of reference. The appearance of the forest, alone, is no longer sufficient. Thorough research and study are needed to establish the relation of different growing stocks to increment in various units, products, and quality classes.

The "Normal Forest" as an ideal.—The concept of the "normal forest" developed in Europe as an ideal to guide the forest manager. After their forests were seriously depleted, the need for heavier growing stock was recognized and the theory developed that maximum volume increment would be obtained with normal full stocking.

This led naturally to the ideally organized and regulated normal forest with: normal increment, normal distribution of age classes, and normal growing stock. A normal stand is synonymous with a fully stocked stand (*27*) in which all space is effectively occupied but ample room is available for the development of crop trees. This ideal forest was pictured as having closely fitted crowns that wasted no sunlight and that each crown was matched with a root system of similar extent so that soil, as well as sunlight, was fully utilized.

Normal yield tables were then developed to describe this normal forest. They were prepared for pure even-aged stands based on carefully fostered stands that had been kept normal by periodic light thinnings designed to avoid waste of soil and sunlight. Normal yield tables were based on remeasurement of such plots, including volume from thinnings. Wiedemann (*34*) has pointed out that these tables silently promote the implication that foresters should bring their stands to full stocking.

Early American foresters, trained in Germany, brought this concept of normal yield tables to us. In the absence of managed stands and with volume cut in thinning of little importance, it was assumed that fully stocked natural stands would provide a usable approximation that would serve until records from managed stands became available.

Thus our normal yield tables of 20-odd years ago (*4*, *10*, *16*, *17*, *18*, *24*, and *25*) were based on single measurements of untreated plots in "fully stocked stands." In obtaining plots for these tables, it was often difficult to determine in the field whether or not a stand was normal. As a result, many of the plots taken were in stands that seemed as fully stocked as possible; and methods of statistical analysis were used to reject a few of the most different plots. It is doubtful if such tables should be called "normal yield tables."

Experience with managed stands here and in Europe over the past 50 years or so has failed to support the assumptions used in developing the concept of the normal forest. It has been shown repeatedly that gross increment varies surprisingly little over rather wide variations in stand density (*20*). Instead of a presumed optimum level, there has been found to be an optimum range of stocking which varies with species, but which is narrower on poorer sites, where the retarding effect of over-stocking is greater (*34*).

Evidence is accumulating to make obsolete the idea that maximum volume growth is obtained with normal stocking. Instead, heavy thinnings provide earlier returns, thus reducing final cut, but not at the expense of total yield. Thus, at Schifferschaftwald in Baden, the current cut is 9/10 increment and 1/10 reduction of growing stock. Heavy and even accretion thinings are common in Germany. Danish thinnings are even heavier in terms of the residual stands; for while the cuts themselves are light, the interval is short—3 and even 2 years at Frijsenborg. The end result is that equal volume production can be obtained from a much lower growing stock than had been considered necessary, and that the growth possibilities for a given site can be placed on the best elements of the stand more easily. The forest manager has much more flexibility: he is able to grow larger diameters in a shorter time, to secure earlier and greater returns from thinning, and to extend financial rotation age.

Stocking in relation to mensuration.—The concept of stocking has its most definite application in yield tables and allied mensuration work. This has been regarded as being limited to the fully stocked stands of "normal yield tables." If stocking is to be related to best growth and management — that is, the stand we expect to provide maximum value return—it becomes clear that we must recognize not one ideal forest, but a series of alternatives whose relative desirability depends on a combination of silviculture, management, and economics. Thus Wiedemann (*33*) presents tables for several grades of thinning, completely freed from the normality concept, that permit foresters to choose those best suited to their stands and markets.

Measurement of Stand Density

It has been noted that stocking is comparative to the stand desired while stand density is expressed numerically. We shall next review and attempt to evaluate the various measures of stand density that have been used or proposed.

First, crown closure and stocked quadrats are eliminated as being special measures not germane to this report. Crown closure and other expressions pertaining to crowns are relative to area occupation and are more properly indications of coverage than measures of stand density. Stocked quadrats provide a measure of the adequacy of regeneration while the seedlings are too small for easy measurement as trees.

Stand density is usually measured in terms of some combination of four basic factors: *diameter*, *height*, *form*, and *number of trees per acre*. Our terminology definition of stand density lists: number of trees, basal area, volume, or other criteria. Because of the great range in size of trees after they begin to constitute a stand, number of trees alone is meaningless unless coupled with some measure of size. Our consideration of measures that have been used is by groups based on number together with one or more of the other basic factors.

What is a desirable measure of stand density?—We can begin by saying that a measure should be clear, consistent, objective, and easy to apply. Correlation with volume increment has been considered a desirable attribute. According to Spurr (*28*), the measure of density should be unrelated to the character and age of the stand and quality of the site.

It does not follow that any one measure will serve best for all silvicultural systems and stand compositions. Nor it it likely that any measure can yield consistent results when applied to growing stock ranging from those deteriorated by centuries of abuse and neglect to the thrifty managed stands developed under the guidance of skilled foresters. Starving, sickly, or superannuated trees are not growing stock and should be eliminated from the stand. Inclusion of such trees in measuring density leads only to confusion.

Number of trees per acre in relation to diameter.—Measures using number of trees in relation to diameter include: number of trees by average d.b.h., stand density index, basal area, and space per tree expressed as diameter plus or times a constant. These, of course, may require further specification as to site, age, stand structure, etc. It is evident that varying arrangement of trees, in groups or otherwise, may be significant in considering stand density.

NUMBER OF TREES BY AVERAGE D.B.H. is seldom used in this form. It serves as a step in the use of stand-density index, which is described below. And it is equivalent to spacing in relation to diameter.

SPACING IN RELATION TO DIAMETER is just another way of expressing number of trees per acre in relation to diameter, with some minor variations due to pattern of arrangement. The usual square pattern assumed is admittedly not precise, and theoretical problems develop in trying to maintain a consistent pattern with repeated thinnings. But these objections are trivial in face of the very real prac-

tical advantages of assuming arrangement in squares. Spacing of itself does not measure stand density, but the corresponding number of trees or basal area does.

Matthews (*15*) derived a formula relating distance between trees, d.b.h., and basal area that expressed spacing as

$$\frac{185d}{\sqrt{\text{basal area}}}$$

which, if basal area does not vary, is diameter times a constant. This is convenient for those who seek to maintain a constant basal area. Mitchell (*19*) suggested D plus 6 as a rule of thumb for farm woodlands in the South that would approximate desirable stocking. Other constants have also been suggested. "D.b.h. plus a constant" results in too much basal area with large trees and too little with small trees (*29*). Lexen (*12*) and Chisman and Schumacher (*5*) tried a parabola to obtain a better description of growing space in relation to d.b.h., but this lead has not been followed.

STAND-DENSITY INDEX, proposed by Reineke (*23*) for even-aged stands, is number of trees per acre as a percent of the number representing full stocking for the same average diameter in unmanaged stands. It promised elimination of age and site as variables, but there is doubt if this promised elimination is warranted. Empirical yield tables have been prepared using density index as a variable (*14, 21, 22, 32*). Desired growing stock in Douglas-fir appears to vary in stand-density index (*3*). And, if basal area is just as good (*28*), it should be preferred because it is more simply obtained. The procedure is not really easy to use and may be inconsistent. Thus, although it is definite, it does not appear to be a good measure of density.

BASAL AREA is often regarded as the standard unit for measuring stand density (*4, 28, 29*) and has the sanction of long usage. In Europe, it had early appeal because when multiplied by average height and form factor, it gave cubic volume. In managed stands, it is less affected by site and age (*34*) during the rotation, the influence of increasing diameter being offset by decreasing number of trees. And it is simple, objective, and easy to use.

Yet basal area leaves many dissatisfied. It gives the same weight to equal areas of biologicaly dead heartwood and functioning sapwood; to young trees and old trees; to suppressed trees and dominant trees; and so on. Also, there is question whether the square is the proper exponent of diameter: the part that grows, the circumference, is given by the first power.

Furthermore, stand density, the quantity to be measured, affects tree form and thus basal area (*36*). The forester guided by basal area alone could be misled by the inflation of basal area that results from initial wide spacing in plantations and some old fields. Basal area also ignores height altogether. And, finally, stands of equal basal area may have divergent yield capacities in terms of usable products.

In a selection forest of balanced structure, many of these objections become trivial because relative abundance of trees by size classes is reasonably constant. Even with unbalanced structure, basal area may be an acceptable measure of density in many-sized stands (*8*). There can be no doubt that basal area will be used as a measure of density in many-aged stands for some time to come.

Number of trees per acre in relation to height.—SPACING IN RELATION TO HEIGHT, suggested by Wilson (*35*), is the only proposed measure of density that uses number of trees in relation to height. Its merit as a measure of density is that height of dominants has been considered to be unaffected except at the extremes of density. Thus the suggested yardstick for stand density is an independent factor—height—rather than a correlated resultant of density—diameter. Wilson expressed the relation by the formula:

$$\text{Number of trees} = \frac{43{,}560}{[f(\text{total height})]^2}$$

where f is a fraction of total height.

The formula is completely abstract as to species, age, site, or desirable stocking. The line for any value of f has a 2:1 slope on log-log paper; a series of such lines provides a grid on which the course of experimental plots or yield tables can be plotted and evaluated. This is true because height in an even-aged stand combines the results of age and site in one measurement, as noted when first proposed.

Spacing in terms of height can be traced back to Hart in 1928, according to Hummel (*11*). It was used in Holland, basing height on the tallest tree on each 100 square meters to avoid possible influence of grade of thinning if average height is used. Ferguson used height as a guide to thinning in Java (*9*). Stahelin (*29*) found spacing in relation to height an acceptable measure of density in the usual even-aged stand of loblolly pine. Eversole (*7*) and Steele (*30*) report density has affected average height of Douglas-fir: these results should be evaluated to determine if this influence is significant to the use of height in measuring density. For a red pine plantation, three times thinned to the same "*f*," Wilson (*36*) found that, for the residual stands, cubic volume continued to increase, and basal area declined with improved tree form, while bole area (computed from the average tree) remained relatively constant.

Thus it is seen that this proposal is clear, consistent, definite, objective, simple, and easy to use. It lacks adequate testing, however, and further study and trial of this proposal is urged. Your committee joins with Hummel in his plea for standardization: with use of "top height" or height of average dominants, and assumption of square, rather than triangular, spacing.

Number of trees in relation to diameter and height. — The new measure of stand density proposed by Briegleb (*3*) in setting standards of numbers, basal area, or growing space, was derived from definitions of normal number of trees and normal height (*16*). His tables show suggested standards by height and diameter. This is an in-

genious suggestion that merits further exploration.

Number of trees in relation to diameter, height, and form.—VOLUME is the most obvious measure of density based on all four of the basic factors. As total cubic volume, it is definite and objective. Like basal area, volume also includes biologically dead heartwood. It might be more easily obtained if form factors had not been so neglected in this country. Volume in board feet measures forest capital and lies in the field of economics. Although undoubtedly useful in this sense, volume in board feet conceals more than it reveals in silviculture or forest management. Volume, qualified by numbers of trees and average size, is far more meaningful to a forest manager than volume alone. For the present, volume does not seem to be a good measure of stand density.

BOLE AREA, a concept contributed by Lexen (*13*), is also based on all four factors. Measuring surface instead of volume, it does not include heartwood. Since surface is roughly equivalent to cambium, it is a measure of the actual growing stock which lays on merchantable wood. Useful approximations of bole area may be obtained from data for the average tree and a factor that ranged between 6.6 and 7.2 for mature even-aged ponderosa pine. Ploting total bole area, before and after thinning, over corresponding stand density in terms of height suggests a straight-line correlation (*36*). The concept is not promising for hardwoods without a definite central stem, but the idea should be studied further for application to species which maintain a well-defined bole deep into the crown.

Research Needed

We have described the current situation as regards the concept of stocking and measures of stand density. Several blanks in our knowledge have been recognized. It is evident that there is need for considerable basic research before we can use these measures as effectively as we would like. In this basic approach, the individual tree in relation to its growing space should be studied.

The importance of better use of our forest land and the long time required to build up the requisite stands make it imperative that we start the necessary research promptly. The major problem is a better definition and understanding of the relations of variation in stocking to best growth and management. The most important subjects for study follow:

1. Determine the range of stand densities which will result in maximum yield by sites for the major forest types.

2. Determine the relation of variations in stand density within this range to product output and quality.

3. Study, compare, and test the more promising measures of stand density in relation to amount and quality of increment and yield.

4. Provide for the eventual preparation of yield tables for managed stands that would be truly descriptive of American forests. These tables should be for many-aged as well as even-aged stands and should show the influence of variations in composition and stand density on amount and quality of yield. These tables should be based on experience from permanent plots that have been carefully tended over a long enough period to be truly definitive.

Summary and Recommendations

Your committee has examined the concepts of stocking and related ideas. Stocking is a relative term based on the stand desired, while stand density is measured in absolute units on an area basis. The stand desired depends on the limitations of site and species and on what the owner wants. The correlation of net or gross growth with growing stock, intuitively expected, has not been established in many cases where plots have been remeasured.

Many characteristics of a stand have been used or suggested to evaluate stocking or to measure stand density. Basal area and numbers of trees by average diameter, despite some deficiencies, have been the units most frequently used.

It is apparent that certain measures of density are better suited to some forest types and silvicultural systems than to others. There is urgent need for more thorough understanding of the basic relations involving the components of growth as affected by variations in stand density.

A suggested program for research in the evaluation of stocking and related phenomena has been submitted. We recommend and urge that this program be undertaken in the vigorous fashion that it deserves. We also urge accurate and consistent use of the terms relating to stocking, distinguishing it as relative to a desired density which is measured in number of trees, in terms of their diameter, height, or form.

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Forestry Education in Northern Europe[1]

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SINCE THE FIRST forestry school of collegiate rank was established in the United States in 1898, forestry education in the nation has tended to become increasingly diverse and pragmatic. There has been a strong swing away from the early preoccupation with technical forest management modeled after German and French practice and the development of an indigenous forestry with an emphasis on organization, protection, and the immediate problems of exploitation. This has been reflected in part by the proliferation of curricula into such related fields as range management, logging engineering, forest products, and wild land recreation.

With the passage of nearly sixty years, it may well be that American forestry education is now about to come almost full circle. Decades of patient effort have borne fruit in a favorable economic setting, and forest management has developed at a very rapid rate in the period since World War II. The problems of technical forest management are becoming indigenous and wholly practical problems. The forestry schools must accept the responsibility for educating professional forest managers as well as practical land administrators. Thus at the present stage it may again be timely to consider the educational organization followed in nations with substantially longer experience in forest management than the United States. With the present strength of American forestry, there is now little danger of importing concepts inappropriate to domestic conditions. At the same time there is sufficient background so that consideration of a different perspective in forestry education can be of value.

The Region

For this purpose a review of forestry education in the most northerly group of nations in Europe seems particularly appropriate. A vast forest of 128.6 million acres, primarily spruce, pine, and birch, sweeps across Finland and Sweden into Norway (*4*). Sweden and Finland are the two leading European nations in terms of volume of industrial wood cut annually, producing one-third of the total European output (*1*). Despite its less extensive forests and lower cut, Norway is completely a part of the same forest economy. In all three nations the forests and forest industries play a major economic role. Forest management is recognized as essential and is strongly supported by public policy (*3*). All three nations are heavily dependent on the export trade and must manage their forests and forest industries on a cost basis consistent with this highly competitive market situation. Thus there is a guiding economic philosophy in forest management which differs markedly from that of the other European nations. In both its economic conception of the forest and its prevailing democratic traditions, this important forest region is readily understandable to American foresters.

Denmark, the fourth nation considered here, differs sharply from the other three in its forest resources and forestry traditions and problems. However, it is closely tied to Norway and Sweden by historical, cultural, ethnic, and linguistic bonds. The forestry movements of the four nations, Denmark, Norway, Sweden, and Finland, have been brought together in the *Nordisk Skogsunion* ("Northern Forest Union"). On the basis of this recognized mutuality of interest this discussion will consider forestry education in all four nations.

Norway

With 3.3 million people in an area of 76 million acres, Norway is a nation of sparse population scattered over a beautiful, but economically difficult, mountain region. Only 2.7 percent of the area is under cultivation, so the 17.8 million acres of forests which cover 24 percent of the land are the major form of land use. Forest production is intimately related to both the agricultural and the general economy. However, with a cut which is roughly one-fourth that of either Sweden or Finland, the resources which can be devoted to forestry education and research are necessarily limited. The problems in forestry education are basically those of a small school in a region in which forestry is both important and well developed.

General education.—Since professional forestry education is the final stage of an entire educational process, it is necessary first to review briefly the general organiza-

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tion of education in the nation. Basic education in Norway begins at the age of 7 years (without kindergarten) and normally covers eight years. The first seven years are given at the elementary schools, after which students usually follow one of three choices. They may go either to one of the various terminal "youth schools," to the *real skule* for three years of more advanced education preparatory to commercial or similar lines of work, or to the *artium* for a five-year program basic to matriculation at the University of Oslo or the other Norwegian colleges.

With university education limited to a select group (less than 5,000 university-level students in all fields from a population of 3.3 million) the *artium* provides rigorous education in either the mathematics-science, the modern languages, or the classical languages line. Completion of the *artium* examinations indicates an educational level roughly equivalent to the sophomore year in college in the United States.

Education in forestry.—As is generally the case in European countries, there are two distinct levels of employment in forestry in Norway, with distinct lines of education being established as basic to each. The "lower" education in forestry provides for the training of vocational foresters who work essentially at the foreman level, while the "higher" education provides for the education of the professional foresters. Career distinctions between these two levels are clearly maintained in public service and, to somewhat lesser degree, in private employment.

Vocational training.—The vocational forestry schools are one of a number of types of special vocational schools which train students for agriculture and the various trades. There are four of these lower forestry schools in Norway, established successively in 1876, 1880, 1911, and 1950. The older three schools are national in character, being operated directly under the Ministry of Agriculture, while the most recent school is operated by a major local governmental unit. However, the curriculum at each school must be approved by the forest director of Norway; all schools use the same textbooks; and all the regular instructors are graduates of the same professional forestry school.

The program was recently increased from one year to one and one-half years in length. Each school admits 24 students to a class, but through the use of staggered admission dates the average number of graduates is held at about 84 men per year from the four schools combined. On completion of the program the students receive the title *Skogtekniker*, which is usually translated as "forest ranger."

The minimum age for admission is 18 years, but the average age of the students actually is 22 years. The men must have completed eight years of schooling and have had a minimum of one year of practical experience in forestry and logging. Many of the students have several years of practical experience prior to admission.

With these mature and experienced students, the program requires full time and the students are resident at the school. The regular staff of each school consists of a director and three instructors, with additional visiting lecturers covering certain material. The curriculum consists of two distinct parts. The theoretical instruction includes about 1,400 class hours of both technical subjects such as silviculture, logging, mensuration, and forestry accounts and basic subjects such as mathematics, drafting, and language. The practical instruction covers about 150 days of field work in silvicultural practices, forest technology, mensuration, and miscellaneous subjects. The students work in groups of 4 to 6 men in this field instruction, with each group under a supervisor who is a graduate of either a "lower" or "higher" forestry school. As would be expected from the intensively controlled nature of this program, the graduates of the vocational schools are thoroughly grounded in the accepted methods and field skills of their calling.

Dual function.—Under any such program involving highly specialized education in forestry with a sharp distinction between vocational and professional aspects there is, of course, a basic problem in correlating these two levels. The Norwegian solution to this appears to be unique. All students taking the higher education in forestry are required first to complete the program at one of the vocational schools.

Since students taking the higher education are also required to have the *artium* education or its equivalent, the result of this requirement is that the vocational forestry schools have students of two very different educational backgrounds and objectives. Instructors at these schools state that the difference in educational background is not serious, since the greater educational background of the one group tends to be offset by the greater experience background characteristic of the other group. However, examination of the textbooks used indicates that the theoretical instruction must be pitched at a level well below the capacity of the students with the *artium* background. The difference in educational objective is commonly ignored, with the vocational schools taking the position that their function is simply to provide well trained vocational foresters. Any coordination of the material covered is considered to be the responsibility of the higher forestry school.

In view both of the level of theoretical instruction at the vocational schools and of the duplication of coverage by the lower and higher schools, there appears to be a serious question as to whether or not this arrangement is an efficient use of the time of the students taking the higher education. This is particularly true since the recent lengthening of the vocational curriculum. However, it is argued that this arrangement enables a wiser selection of students for the higher education and that, since the professional forester must supervise

the vocational forester, it is essential that he be completely familiar with such work. On these grounds the present arrangement receives strong support from many Norwegian foresters and there seems to be little probability of change.

Professional education.—To be eligible for admission to the higher education in forestry the student must have completed the *artium* program (mathematical line recommended), must have completed the program at a recognized lower forestry school, and must have had two years of practical experience. In addition to these requirements, the student must also be selected for admission. The higher forestry school admits from 33 to 35 students every two years, while the list of applicants has numbered around 80 in recent years. At this rate of admission, the ratio of men with the higher education to men with the vocational education only is maintained at about 1 to 4.

The higher education in forestry is given at the Norwegian Agricultural College at Vollebekk adjacent to the small community of Ås about 20 miles south of Oslo. This college is operated under the Ministry of Agriculture and has no direct connection with the University of Oslo. The college is organized in five major subject matter divisions, of which forestry is one, plus a general division of basic sciences. Provision for the establishment of the forestry division was made in 1897 and professional instruction began in 1899. The forestry division consists of the Institute for Silviculture, the Institute for Mensuration and Working Plans, the Institute for Forest Technology, and the Institute for Forest Economics. Each of these institutes is led by a professor. In addition, there is a Forest Botany Institute which is somewhat intermediate between the forestry division and the general division.

The size of the staff is basic to the policy of admitting students only every other year. The curriculum covers three years, of which the first is spent in basic sciences and the last two in the professional forestry courses. With a new class coming each two years, this means that only half of the forestry courses must be offered each year. This results in substantial savings in staff time. Despite the obvious efficiency of the system from the faculty standpoint, however, there is considerable pressure at present for annual admissions to provide a more even flow of men into the profession.

The program is based on a single core curriculum, with provision for a very limited amount of specialization.[2] In general, the subject matter coverage corresponds to the general forestry curriculum in most American forestry schools. A notable absence is any significant coverage of forest fire problems, reflecting the minor role of fire in this region. Forest regulation and valuation, which are often combined as "forest management" in the U. S., are separated, with working plans being combined with mensuration and valuation with economics. This arrangement appears both logical and effective.

Considerable weight is given to a thesis requirement which is met during the last year. The subject may be taken under any of the four major institutes. Some minor differences in weights given the various courses and in selection of courses also reflect a minor degree of specialization among the four major fields recognized.

Heavy reliance is placed on lectures. The students are expected to attend lectures from 8:00 a.m. until 2:00 p.m. six days per week during the regular semesters. In addition, there is required field instruction and travel during the summer period. There is a single examination in each subject, which may be either or both written and oral. The examinations are given by the professor in charge of the course, but the college appoints an outside specialist in the field as a censor. The censor examines all questions in advance, is present at the examinations, and grades the examinations. The average of the professor's and the censor's grades is recorded. Failure in examinations is not common, and the pressure on the students seems to lie more in the belief that their record will influence their employment than in fear of failure.

The students average about 25 years in age and are resident in dormitories at the college. There is no tuition, but the economic pressures of living expenses and earnings foregone are heavy for most students. Opportunities for part time employment are extremely limited. There is, however, a liberal system of state loans for students and over 60 percent of the students have such loans.

Upon completion of the program the students receive the title *Forstkandidat* (officially *Skogsbrukskandidat*) which is best translated simply as "Forestry Graduate." It is a professional degree which may be taken as roughly comparable to the Master of Forestry degree in the United States.

Post-graduate study.—There is no provision for organized graduate study in forestry comparable to that of a number of American forestry schools. There are, however, usually five or six forestry graduates who have returned to the college under various stipends to study specialized problems. Such programs are usually based on extensive reading in the field, but may include some research in their later stages. These stipends are provided by both public and private grants and are comparable in amount to the earnings of men of the same education and experience in regular employment. Such stipends are usually held for periods of two or three years. These men do not work for nor receive any advanced degree.

The college is authorized to grant the degree of *Dr. Agro.*, which is based entirely upon submission of a dissertation acceptable to the faculty of the college as a major research contribution. This degree has been awarded to five foresters. None of the forestry professors holds a doctoral degree.

[2]Copies of the curricula of the schools covered by this article are available from the writer on request.

Faculty.—The procedure for the appointment of professors is of considerable interest. There is no hierarchy of professorial ranks as in the United States, but only the single level, professor. When a new professor is to be appointed, an official advertisement of the position is made and publicized. Formal application for the position must then be made by anyone desiring to be considered for appointment. These applications must be accompanied by copies of research publications and similar evidence. A committee of specialists is then appointed to review the applications. The size and composition of such a committee is variable, but it may include other recognized national authorities in the field, professors of the same subject in the other northern European nations, and in some cases the retiring professor who is to be replaced. This committee lists the applicants as qualified or not qualified and recommends the qualified applicants in order of choice. These recommendations are transmitted through channels to the Council of Professors and from the Council to the Minister of Agriculture who holds the ultimate authority to authorize appointments. The recommendations are not binding, but are usually followed. This procedure obviously places great emphasis on research accomplishments, but other factors are also considered.

Research.—Research is a recognized function of the school, but instructional activities receive priority in time. Prior to World War II the school carried out only a limited amount of research, but following the war there has been a great expansion in such activities. The school is entirely separate from the Norwegian Forest Research Institute, which is also a branch of the Ministry of Agriculture and is located in a well equipped new building in Vollebekk about a half mile from the forestry school. However, there is cooperation between the two groups and the college research findings are often reported in the Research Institute series.

Sweden

With an area of 101 million acres and a population of 6.7 million people, Sweden is the largest of the North European nations. The 9 percent of the area under cultivation is adequate to make the nation largely self-sufficient in agricultural products. Development of excellent sources of high-grade iron ore have led to a highly organized industrial economy. The 57 million acres of productive forest land are the most extensive of any European country and sustain the highest annual cut of industrial wood. The terrain is generally rolling, with excellent stream transportation of logs in the northern portions. With these natural resources and an industrious people, Sweden has long been one of the more prosperous nations of Europe. The excellent facilities for forestry education reflect both the wealth of the nation and the importance of the forests and forest industries to its economy.

Vocational training.—As in Norway, there is provision for two distinct levels of forestry education. The lower forestry education is given at five state-supported "ranger schools." The course requires one year. Approximately 100 students are graduated annually. Since approximately 30 students complete the higher education each year, the ratio of vocational to professional foresters is maintained at slightly more than 3 to 1.

In addition, a second year of vocational instruction is provided at a state-supported "forest master" school. Twenty selected graduates of the one-year course are trained at this school each year.

Before being admitted to one of these lower forestry schools, the men must complete a four months practical forestry course. Applicants for the ranger schools must have a minimum of 20 months of practical experience before taking this practical course.

Professional education.—Higher education in forestry in Sweden started in 1828 with the establishment of the Royal Forestry Institute in Stockholm. In 1915 this Institute was reorganized on a college basis as the Royal School of Forestry. The Royal School of Forestry is an independent college-level organization placed under the Ministry of Agriculture. The School of Agriculture and the School of Veterinary Medicine are also under the Ministry of Agriculture, but the three schools have no direct academic relationship.

The Royal School of Forestry and the Forest Research Institute are placed under the same Board of Supervisors appointed by the government. The two organizations are located in separate buildings on the same grounds and share a common library facility. However, they operate as entirely separate institutions.

The headquarters of the school are located in an open park-like area on the edge of a lake within a few minutes ride of central Stockholm. The main building is spacious and excellently equipped. The library is housed in a separate building opened in 1954. With the student dormitory, the buildings of the Forest Research Institute, and various minor structures the area forms a complete campus. A second campus is maintained at Garpenberg in central Sweden, where the students take much of their work, and additional permanent buildings are maintained in other parts of Sweden. In physical facilities as well as in caliber of faculty, the Royal School of Forestry is clearly one of the outstanding institutions of its kind in the world.

Faculty.—The school is organized in eight departments under the *Rektor,* who is nominated by the faculty and, after approval by the Board, appointed by the King. The eight institutes are Forest Soils, Forest Botany, Forest Economics, Silviculture, Mensuration and Working Plans, Forest Zoology, Wood Technology, and Work Studies. Each institute is led by a professor. There are sixteen additional full time professional level positions as assistants and lecturers in the institutes, as well as clerical and laboratory help. In addition to this regular staff, there are seventeen outside experts appointed

as special teachers to cover various topics such as photogrammetry.

Appointments to the faculty are made on a basis similar to that in Norway, with public announcement, formal application, and review by a committee of specialists in the field involved. In the basic science departments of soils, botany, and zoology it is necessary that applicants hold the Ph.D. in the field from the University. These professors ordinarily are not graduates in forestry themselves. In the applied forestry departments the doctor's degree is not required, but all the professors are forestry graduates.

Students.—To be admitted to the Royal School of Forestry, students must have completed the *artium* education with a satisfactory record on the matriculation examination. Completion of the science line meets all educational requirements, while students from the modern or classical languages lines must pass special examinations in the additional subjects required. In addition, twelve months of practical work are required. This work must include the four months practical forestry course which is also taken by the men going to the lower forestry schools, five months on a forest district working under a forester designated for this purpose, one month at a sawmill, and two additional months of any type of forest work.

Admission of students has been limited to 30 per year, but due to a current shortage of foresters in Sweden the number will be raised to 36 for a 5-year period, after which it will be reduced to 30 once again. During recent years the number of applicants has been about 20 percent higher than the number selected. One-third of the students are selected solely on the basis of the *artium* record in order to secure brilliant students for forestry, while the remaining two-thirds are selected on the basis of *artium* record, practical work, and military service. During the period 1950—1953, the entering students averaged 23 years of age with 17½ months of practical experience.

Curriculum.—The School offers only one curriculum in forestry, which is designed to be completed in three and one-half years, including three full summers of instruction. Actually many of the students spend four complete years in completing the program. The work is organized in eleven semesters, with the first, second, and sixth being taken at Garpenberg, the fourth in South Sweden and Norrland, the seventh in Malingsbo, and the tenth in travel. Thus the student spends not more than half of his time at Stockholm and is brought into close working contact with all the major forest conditions of Sweden. Field work, technical forestry instruction, and education in the basic sciences are developed in intimate conjunction. It is interesting to note that small woodland management is not considered until the tenth semester, since this is held to be the most difficult problem in forest management. The eleventh semester is devoted to special lectures, seminars, and intensive individual study.

Upon satisfactory completion of all work and examinations the student is awarded the degree *Civiljägmästare*, commonly abbreviated to *Jägmästare*. This is a traditional title literally translated as "Master of the Hunt" but better termed "Forestry Graduate." It appears to indicate a degree of maturity and professional specialization perhaps most nearly comparable to the Master of Forestry degree in the United States.

Post-graduate study.—In addition, the Royal School of Forestry is authorized to grant the degrees *Skogsvetenskaplig licentiat* ("Licentiate in Forestry") and *Skogsvetenskaplig Doktor* (" Doctor of Forestry").

The licentiate degree has been established for a number of years, but it is estimated that the average number of such degrees granted is not more than one per year. The student must pass qualifying examinations in the literature of a major and minor field and must prepare a dissertation (usually printed) on a special topic. It is estimated that the program would reguire two years by a full time student, but it has been found extremely difficult to attract such students even though stipends in support of such studies are available. Most candidates for the degree are men working as assistants at the school or in similar capacities.

The doctor's degree has been authorized for only a short period and had not yet been granted in the spring of 1955. The degree is based on published research reports, which may be either one major work or several smaller works which in total constitute a major contribution to a particular topic.

Research.—All of the institutes in the school carry out some research, with the time and funds for such research varying considerably among the institutes. Except in the case of forest work studies, such work is independent of the program of the Forest Research Institute.

Finland

Forests cover 54 million acres or 72 percent of Finland's total area of 75 million acres. This fact is of dominant importance to the nation and its 4.2 million people. More than any other country in the world, Finland has truly a national economy based on wood (*2*). Heavily damaged during World War II, reduced in territory, and under the burden of heavy indemnity payments to the Soviet Union which distorted the nation's basic economic structure, Finland's resurgence to its traditional major role in the export trade in forest products has been most impressive. The tenacity and spirit represented by the Finnish word *sisu* are evident on even a brief visit.

The basic economic significance of the forests and the scientific standing and political stature which some foresters have achieved are all fully reflected in the system of forestry education. In both caliber of faculty and physical facilities professional forestry education in Finland is justifiably world famous.

Vocational training.—The vocational or lower forestry education

is given at six state-supported schools, five in the Finnish language and one in Swedish. In addition, from one to three private schools have operated, giving comparable degrees. The course requires two years, and each school admits students only every other year. Competition for admission to these schools is very keen, with each school selecting 40 to 50 students, usually from about six times this number of applicants. Applicants must have completed the elementary schooling, and nine years of schooling is common. One year of practical experience is required, but due to the heavy competition at least two years is usual.

Professional education.—Higher education in forestry is given at the University of Helsinki. The School of Forestry and the Forest Research Institute occupy the "forestry house," a very large and impressive five-storied U-shaped building. The library, laboratory, office, display areas, and student work areas are all large and well equipped. The building is at the corner of the main group of University buildings in the center of Helsinki and tends to blend with the various store and office buildings of the area. Thus there is nothing of the campus scene familiar to American forestry students.

Organizationally, higher forestry education has a strong resemblance to a number of the large forestry schools in the United States. The forestry school is a part of the major university, there is no practical experience requirement for admission, the program covers four years, and there are several different curricula in forestry. Operationally, however, there are many differences from American practices.

Higher education in forestry began with the establishment of Evo Forest College in 1860. The location in a sparsely settled forest district 70 miles north of Helsinki proved inconvenient, and in 1908 forestry education was transferred to the University of Helsinki, where it is now under the control of the Faculty in Agriculture and Forestry. The University of Helsinki is the national university, with an enrollment of about 9,000 students. Despite this affiliation, however, the education is closely controlled by the faculty in forestry. During the first year the students take certain basic courses in common with agricultural students, but there is apparently no direct use of departments outside the Faculty in Agriculture and Forestry.

The forestry branch at present includes seven institutes with eight professors. The institutes include Silviculture, Forest Mensuration and Working Plans, Swamp Forestry, Forest Technology, National Economics of Forestry, Business Economics of Forestry, and Forest Protection. It is hoped that an Institute of Forest Marketing will be established soon. An additional major position in the faculty is that of University Forester. Each of the professors has one or two professional level full-time assistants who handle the routine administrative work, carry out research, and work in similar capacities. In addition, the school makes extensive use of outside specialists as lecturers, with about 20 such positions being filled at present.

The procedure for the appointment of professors is similar to that of the Scandinavian forestry schools. University standards must be met, and it is now necessary for all appointees to have the doctor's degree.

Applicants for admission as students must have completed twelve years of schooling, which begins at age 7 years and extends roughly to the level of the sophomore year of American colleges. The matriculation examination includes written examinations in Finnish, Swedish, a foreign language, a choice of mathematics or certain other subjects, and in addition oral examinations in all subjects studied. There is no requirement for practical experience for admission to the higher forestry education. It is pointed out that the typical student is 19 when he finishes school and, after a year of military service, is 20 when he enters the University. It is not considered desirable to defer higher education beyond this age.

The number of students admitted is controlled, with the number being set each year. Currently 35 students are admitted annually from about double this number of applicants.

Curriculum.—For a number of years the school operated with a single curriculum. Due to the increasing complexity of the subject matter, however, a system of specialization in six different lines was established in 1944. These six lines are the general branch (silviculture and management), the technical branch (wood technology and logging), swamp forestry, forest protection, the economics branch, and the commercial branch (a combination of forestry and business administration). The programs under these six branches differ both in basic subjects and advanced work, so that it is necessary for a student to select his specialty immediately upon entering the University. Due to the problems this involves and the fact that few if any students are following certain of the lines, consideration is being given to revising the program. There is considerable support for a proposal under which all students would take a common first year, followed by specialization in one of three branches.

The general approach can be shown by tracing the program under the general branch. The first year is devoted to lectures in the fundamental subjects plus introductory coverage of the technical subjects. This is followed by a three months summer period at the silvicultural training station in a 42,000-acre state forest under the technical control of the University. Great importance is attached to the silvicultural training which is given by the University Forester with some general supervision by the Professor of Silviculture, since it is felt that this sets the basic silvicultural philosophy of Finnish foresters. The second year covers auxiliary subjects such as soils and begins the lectures in

the main subjects. The second summer is spent preparing a complete map, inventory, and working plan, first for a large property and then for a farm forest In the third year the lectures on the main subjects are completed, seminars are started, and the student begins work on his thesis This third summer is spent in practical experience, with one month in floating, one month in sawmilling, and one month in summer logging. In the fourth year there are no lectures. The students prepare for examinations, participate in seminars, and present their main papers. A period of 2½ months is spent in winter logging, with the students forming their own logging camp.

On completion of the four year program the student receives the degree of *Matsänhoitaja*. Although this is considered to correspond to the American degree, B.S.F., it actually appears to represent an educational level more nearly comparable to the Master of Forestry.

Post-graduate study.—The system of granting advanced degrees is more completely established in Finland than in the Scandinavian countries. Three different levels of advanced degrees are granted: a Master's degree, a Licentiate degree, and a Doctor's degree.

The Master's program is based on an organized work taken in residence. The intent is to provide depth in certain phases of forest science and is somewhat parallel in purpose to the Master of Science program of American schools. The student must qualify in three subjects with their necessary prerequisites. For the forestry graduate the program usually requires an additional one and a half to two years. However it is also possible to work directly for the Master's degree. In this case the program takes about five years. Since admission to this program is not covered by restrictions in numbers, an odd situation has developed. Students not admitted to the undergraduate program sometimes register directly for the Master's program. After achieving this degree, they then must be admitted to the undergraduate program upon application. This subsequent completion of the lower degree is considered necessary for the man desiring to go into practical work, since the Master's program is too narrow for most types of general forestry employment.

Both the licentiate degree and the doctor's degree are based primarily upon a dissertation representing original research. The candidate must hold either the basic degree or the Master's degree in forestry. In the case of the doctor's degree, the dissertation must be printed and must be defended in public. Since work for these degrees is not ordinarily done in residence and since the men obtaining the degrees usually have regular employment, it is not possible to give an estimate of time requirements which has any real meaning.

Research.—Accomplishments in forest science are emphasized in the selection of the professors and research is considered as one of their normal areas of responsibility. Although time for research is somewhat limited, the university does play an important role in the total research program in Finland. This research is entirely separate from the program of the Forest Research Institute, and the published research reports do not ordinarily come out in the Research Institute series. In this connection it is interesting to note that although the two agencies are housed in the same building, physical separation is maintained through the use of locked doors in the corridors.

Denmark

Unlike Norway, Sweden, and Finland, Denmark is primarily an agricultural country. The actual forest area amounts to less than 1 million acres or about 9 percent of the total area of 10.5 million acres, even though the area of forest has been nearly doubled in the last 150 years through the afforestation of heath and dune areas and other planting projects (*5*). With 4.3 million people, the population density is six times that of Sweden or Finland and twelve times that of Norway. Land use is very intensive, in both farm and forest. With no native conifers of commercial value, Danish foresters are greatly interested in introduced species. Beech is considered the national tree and must be maintained in public forests. Silvicultural practices are among the most intensive to be found anywhere and control of the growing stock is exercised with great skill. With only slight exaggeration, Danish forestry has been described as "a horticultural variety of forestry." Under these conditions Danish forestry education has developed as a remarkable blending of the old master-apprentice system with modern university education.

Vocational training.—Lower forestry education is based primarily on the apprentice system. A man desiring to follow this program must complete nine years of basic schooling. After a year's trial as a laborer on a forest district, he then takes a seven months' course in basic subjects at an agricultural school. At this stage about 30 men per year or 60 percent of the applicants are permitted to continue the program. This further training requires three years of experience, of which two years are spent in two districts of at least 1,000 acres and the last year in one of three districts authorized as training districts. Here the forest officer acts as instructor. Successful completion of a final examination covering both theoretical and practical work results in the award of the title *Skovfogedaspirant*, which might be translated as either "forest ranger" or "forestry foreman."

Professional education.—There has been continuous provision for higher education in forestry in Denmark since 1786, at which time such education was attached to the two light infantry corps at Kiel and Elsinore. In 1800 forestry education was established at the University of Copenhagen and then in 1855 at the "Polytechnic High School," from which it was transferred to The Royal Veterinary and Agricultural College in 1863. Forestry education remains under this college, which is

a state-supported institution providing education in six fields of applied science in agriculture, veterinary medicine, and forestry. The college is located in the central district of Copenhagen.

The forestry section consists of three positions as professor of forestry. There is no recognition of specialization in the authorization for these positions, but in practice it appears to be generally recognized that they correspond to silviculture, utilization, and economics. The system for selection of professors corresponds to that described for the other countries considered here.

Students preparing for university education receive twelve years of schooling extending through the *artium* level, with its choice of the mathematics-science, modern languages, or classical languages line. It may be noted that even the mathematics-science line includes instruction in English, French, and German. The mathematics-science line is recommended for forestry, but there is provision for the admission of other students by examination. Enrollment of students in forestry is less than the capacity of the school but more than the estimated future number of positions for professional foresters in Denmark. This last condition tends to hold applications down and all qualified applicants are admitted. During the past fifty years an average of eight men have graduated annually, with the number in recent years fluctuating around ten or twelve.

Curriculum.—After admission to the college, the student embarks on a program of experience, courses, and examinations which extends over a period of five and one-half years and includes four separate stages. The program begins with the first practice period, for which the man is required to find a position as a student on a public or private forest district of at least 1,200 acres administered by a professional forester with at least five years experience on the district. The student spends twelve months on the district, living at the forest officer's house, doing all types of forest labor, and receiving instruction from the forest officer. During this year he is expected to learn all the material required of the vocational forester, although his practical proficiency may be less due to the shorter period of training. This is followed by the first academic program, which consists of one and one-half years of extensive coverage of the basic sciences at the College.

After this apprentice period and first academic program comes the second academic program, consisting of the professional studies in forestry which extend over two years. Students are admitted to this program annually, but with the small faculty it is considered desirable to offer each course only every other year. Thus the second year's work for one group of students is the first year's work for the other group. While this involves some difficulties in instruction, it is considered the best approach under the circumstances. Admission of students only in alternate years as in Norway is not considered practical, primarily because of the difficulties which this would involve for the forest officers on the districts commonly used for training. During these two years each Thursday is held free for a full day field trip led by one of the professors, and several weeks of each summer are also devoted to field study. In addition to courses and field work, each student is required to prepare a thesis. Oral and written examinations are given in each subject by the professor and two censors (usually district officers) at the end of each year.

The fourth stage of the program is the second practice period, which corresponds to an interne period. For this the student spends fourteen months on a forest district, living at the forest officer's house and carrying out professional assignments under supervision, including surveying, inventorying, and developing a management plan for part of the forest.

A last examination is given which includes the reports of all work during this second practice period plus examinations in all forestry subjects. For this examination all of the students are brought together on one district for a week during which they are examined by all three forestry professors plus a staff of censors. The degree granted on completion of the program is *Forstkandidat* ("Forestry Graduate") which again appears most nearly comparable to the Master of Forestry degree in the United States.

Post-graduate study.—Since 1935 it has been possible for forestry graduates to be awarded the *Dr. Agro.* degree at the College. This degree is not based on graduate study in residence in the American sense, but instead is based entirely upon a research dissertation. Four Danish foresters have received this degree. The Ph.D. degree is granted at the University of Copenhagen for research dissertations in one of the basic fields of learning. Three foresters, including one of the professors of forestry, have received this degree. Since it is now required that candidates for this degree must first receive the basic degree in the particular field from the University it is not considered probable that foresters in Denmark will seek this degree in the future.

Summary and Evaluation

As is evident from the preceding discussion, there is a strong common pattern to forestry education in these four northern European nations, but there are also important differences in requirements and methods. The same, of course, can be said of the twenty-six accredited forestry schools in the United States. There will obviously be exceptions to any comparisons or evaluations which are attempted. Nonetheless, there are certain broad contrasts which stand out and which deserve consideration in American forestry education.

Without doubt the fundamental distinction between the two approaches lies in the European system of providing for two highly developed but distinct levels of forestry education, with roughly four forestry foremen being trained in the vocational program for each

professional forest officer receiving the higher education. With this separation of the vocational aspects of forestry, the functions of the colleges in educating men for the technical, scientific, and economic guidance of forest management has become clearly defined and both the education and stature of professional foresters are correspondingly enhanced. Moreover, it is clear that much of the success of European forest management rests on the skill and understanding with which the forestry foremen carry out the routine work in the forest.

In the United States, on the other hand, vocational education in forestry is very limited and fragmentary. The occupational need for skilled forest foremen has not yet become clearly established. Much such work is carried on by men with no special background for such functions and with knowledge limited largely to their personal experience. At the same time most American forestry schools must recognize that their students include men whose interest is primarily vocational as well as men looking forward to careers at a professional level. The result is inevitably confusion as to the role of the forester for students, faculty, and public alike.

With the increasing intensity of forest management, the needs for increasing professional and vocational competence are becoming urgent. A further development of separate vocational forestry training as in the northern European countries deserves serious consideration.

The standards for matriculation at the northern European forestry schools are distinctly higher than those for admission to the freshman year at the undergraduate forestry schools in the United States. Training in mathematics through calculus and knowledge of at least two foreign languages are indicative of the standards. The factors which appear to be basic to this high matriculation standard include the somewhat higher age range for the first twelve years of schooling, the relatively low proportion of students admitted to the university preparatory program, and the use of longer and more rigorously disciplined instruction periods. These are major educational issues rather than special characteristics of forestry education. However, this condition is of importance in evaluating the educational level represented by the higher education in forestry. It is also of interest to note that formal general education is considered to be completed at the time of matriculation and that the problems of liberal education which are much discussed by American forestry professors do not appear to be of concern in the northern European schools.

The emphasis on practical experience in a labor capacity either prior to or as part of the higher education in forestry also contrasts with usual American requirements. This is accompanied by what appears to be a stronger emphasis on manual and physical skills during the education itself. At first this appears paradoxical, since the American forestry student is much more likely to be engaged in such activities immediately following graduation than the European. Actually, however, this condition may be the explanation of the difference. The American student can expect to serve this apprenticeship in a good pay status following graduation, while the European graduate is not expected to spend time at a labor level. The relative advantages of these two approaches can be argued endlessly. The European student is more mature and better able to carry professional responsibilities immediately following graduation than the American. However, this compares a man of 26 or 27 years of age with a man of 22. The northern European approach seems to ensure a high level of competence at the cost of a deferred or prolonged education with attendant personal, financial, and social problems, while the American approach provides the opportunity for reaching equal competence at an earlier age, but at the cost of a lower average level of professional knowledge and skill.

Apparently as a result of the high matriculation standard, the experience requirements, and the selection of a limited number of students from a large number of applicants the students at the northern European schools tend to be a more homogeneous group than American students. Practically all students admitted to the higher education complete the course successfully and remain in forestry throughout their careers. The process of weeding out weaker students and dealing with men of uncertain aptitude which is part of the American collegiate experience is of little concern in the northern European schools. Employment opportunities are strongly affected by scholastic standing and motivation is more from desire to excel than from fear of failure.

With enrollment limited on the basis of school size and the rather static conditions of forestry employment, the faculty-student ratios are favorable to intensive instruction. In addition, the amount of full-time professional level assistance provided European forestry professors is impressively high. Field work is extensive and is carried out under very close supervision by experienced foresters. At all schools each student must carry out independent work and prepare a major paper or dissertation. Seminar level instruction is common in the final stages. With these characteristics and in view of the length of the curricula and the level of matriculation standards, it is clear that the basic level of professional forestry education in northern Europe is substantially above that represented by the four-year baccalaureate program in the United States. Again, the comparison raises the question of the adequacy of American programs in educating men for leadership in the level of technical forest management which appears to be rapidly approaching.

At the same time, those American forestry schools which are connected with major universities appear to have sources of strength which have not been developed at the northern European schools.

These rest in the close relationships which are maintained with the basic fields of learning and the direct and extensive use which is made of these departments in both the undergraduate and graduate levels of instruction. These advantages are particularly compelling at the graduate level. Although the basic level of professional education in forestry appears to be higher in northern Europe than in the United States, this is not the case at the doctoral level. This doctoral program based on a dissertation representing major research and a knowledge of the areas of learning fundamental to this research is narrower in both conception and guidance than the approach followed in the United States. The requirement of resident instruction at the graduate level and the qualifying examination for admission to candidacy at those American schools in which the doctoral program is closely tied to the fundamental subject matter fields provides for a breadth of education and intimate contact with outstanding authorities in other fields in addition to forestry which does not appear to be present in the northern European programs.

Along somewhat the same line, there appears to be some tendency toward a controlling orthodoxy in northern European forestry. In part this may be a reflection of forest conditions, but in part it is the result of the educational system. Although the intent is to develop principles, the instruction is cast in a strong regional context of limited variety. In Norway, Sweden, and Finland the management of spruce (*Picea excelsa*) is the core of forestry, with pine in an important secondary position and a limited number of hardwoods completing the picture. With the intensity of instruction and the lack of any significant mixture of graduates of different schools within any one nation, the result is an evident indoctrination of forestry graduates with an accepted point of view extending into details of practice. The situation is different in the United States where a free flow of graduates between states necessitates a less regional orientation of instruction and constantly exposes pronounced differences in the views of presumed authorities. Moreover it must be recognized that some individual states in the United States include far more forest species and variety of forest conditions within their own boundaries than can be found in all Europe.

Along with the close relationships with the basic fields of learning, the mutual education which graduate students from different areas and different basic forestry education give each other is one of the great sources of strength in American forestry education at the graduate level. Study of northern European forestry indicates the importance of developing these sources of strength even more fully in the future.

Above all, however, this study indicates the challenge which improving forest management holds for the forestry schools of the United States to continue to raise their standards and to exert professional leadership in the rapidly changing future.

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Statistics from Schools of Forestry for 1956: Degrees Granted and Enrollments

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This article is another in a series of comparable papers appearing annually in the Journal of Forestry since 1934, reporting the enrollment at the schools of forestry and the numbers of degrees conferred. Statistics of this type were first assembled when the Forest Education Inquiry made its study in 1929-1931, and were published in the Inquiry's report in 1932.[1] The annual articles in the Journal have brought to date the figures for each successive year.[2]

THE INCREASE in enrollment which began in the 1953-54 scholastic year has continued this year and totals nearly 15 percent, increasing from 6,038 to 6,933. All classes again show an increase in enrollment, although the increase in the freshman class is less than half of that last year and a fourth of that the year before. Sophomore, junior, and senior classes continue an accelerated increase. Once again *General Forestry* accounts for two-thirds of the enrollment in the junior and senior classes, *Wood Technology and Utilization* for ten percent, and *Wildlife Management* for nine percent.

The master candidates increased from 405 to 430 and the candidates for the doctorate from 161 to 165. Of the total graduate enrollment of 595, 46 percent are in *General Forestry;* 19 percent in *Wood Technology and Utilization;* and 16 percent in *Wildlife Management.*

The number of bachelor degrees granted increased from 828 in 1955 to 911 in 1956, of which 611 were in *General Forestry*, 98 in *Wood Technology and Utilization*, 77 in *Wildlife Management*, and 18 in *Range Management.*

The number of master degrees granted increased from 194 to 226 of which 136 were in *General Forestry*, 34 in *Wood Technology and Utilization*, and 29 in *Wildlife Management.*

The number of doctor degrees granted increased from 31 to 35, of which 14 were in *General Forestry*, 8 in *Wood Technology and Utilization*, and 7 in *Wildlife Management.*

From 1900 through 1956 there have been 24,274 undergraduate forestry degrees granted in the United States; in addition 4,363 master degrees and 405 doctor degrees have been granted (see Table 10).

Introduction

The 1956 statistics on the schools of forestry in the United States are on a slightly different basis than those for 1955 as Mississippi State College and Rutgers University have been included. Thus we now have 26 accredited and 11 nonaccredited schools reporting.

While these new schools increase the total enrollment by less than three percent, Mississippi with 141 undergraduate students has a larger enrollment than any of the nonaccredited schools and six of the accredited schools. It thus promises to be a significant factor in the future in both enrollment and degrees granted.

It has been customary to carry statistics on the number of degrees granted on a calendar year basis and since they are requested in October, the schools operating on a quarter basis have to estimate the number of degrees which will be granted at the end of the autumn quarter. It thus becomes necessary to correct these estimates at the end of the year. For this reason, plus the inclusion of Mississippi and Rutgers, the totals listed for 1955 in the current compilation will differ slightly from those listed last year.

The statistics on degrees granted and enrollment of graduate students were first broken down by specialized curricula in 1953. In 1954 this breakdown was extended to the enrollment of undergraduate students in the junior and senior classes. At that time it was found that there was little segregation during the first two years and a breakdown of the enrollment in

TABLE 1.—SIGNIFICANT STATISTICS FOR 1951 THROUGH 1956

	1951	1952	1953	1954	1955	1956
Bachelor's degrees conferred	1,564	1,267	1,045	957	829	911
Master's degrees conferred	267	226	151	179	194	226
Doctor's degrees conferred	21	25	37	44	31	35
Undergraduates enrolled	4,799	4,691	4,909	5,357	6,038	6,933
Members of freshman class	1,370	1,536	1,698	1,986	2,149	2,220
Members of sophomore class	1,107	1,012	1,168	1,377	1,566	1,807
Members of junior class	1,053	1,013	917	1,032	1,236	1,549
Members of senior class	1,269	1,130	1,126	962	1,087	1,357
Graduate students—master's	344	281	349	423	405	430
Graduate students—doctor's	137	130	139	127	161	165

[1]Graves, H. S. and C. H. Guise, Forest education. Yale Univ. Press, New Haven. 1932.

[2]Guise, C. H. (Eighteen articles on degrees granted and enrollments at schools of forestry in the United States, 1934-1951). Jour. Forestry 32:337-343; 33:402-405; 34:114-120; 35:77-83; 36:12-18; 37:197-202; 38:241-246; 39:359-364; 40:196-202; 41:87-91; 42:357-360; 43:172-175; 44:110-114; 45:174-180; 46:168-173; 47:93-100; 48:165-169; 49:7-12.

Marckworth, Gordon D. Jour. Forestry 50:262-265; 51:256-259; 52:354-358; 53:256-261; 54:316-321.

TABLE 2.—BACHELOR DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1955 AND 1956

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956
Alabama	9	9	1	3	—	—	—	—	—	—	—	—	10	12
California	25	25	—	—	—	—	—	—	—	—	—	—	25	25
Colorado	15	11	6	8	11	8	13	11	4	6	—	—	49	44
Florida	14	9	—	—	—	—	1	—	—	—	—	—	15	9
Georgia	29	30	—	—	—	—	—	3	—	—	—	—	29	33
Idaho	20	10	1	1	3	3	4	5	—	—	—	1	28	20
Iowa	25	18	—	11	—	—	—	—	—	—	—	—	25	29
La. Poly. Inst.	9	13	—	—	—	—	—	—	—	—	—	—	9	13
Louisiana State	12	22	—	1	—	—	—	7	—	—	—	—	12	30
Maine	24	25	—	—	—	—	6	8	—	—	—	—	30	33
Massachusetts	17	13	—	—	—	—	2	9	—	—	—	—	19	22
Michigan State	30	19	5	6	—	—	15	7	1	1	42	52	93	85
Michigan Univ.	21	34	4	9	—	—	2	2	—	—	1	7	28	52
Minnesota	16	15	8	2	—	—	—	6	—	—	1	10	25	33
Missouri	19	13	—	—	—	—	—	—	—	—	2	1	21	14
Montana	24	18	—	3	4	2	3	1	—	—	—	—	31	24
New York	43	46	22	21	—	—	—	—	—	—	27	28	92	95
North Carolina	19	23	14	4	—	—	—	—	—	—	—	1	33	28
Oregon	30	42	7	5	—	—	—	—	—	—	—	—	37	47
Pennsylvania	48	41	2	9	—	—	—	—	—	—	—	—	50	50
Purdue	24	25	4	2	—	—	—	—	—	—	—	—	28	27
Utah	4	15	—	—	5	5	6	7	—	—	—	—	15	27
Washington Univ.	25	32	3	11	—	—	—	—	—	—	—	—	28	43
West Virginia	17	10	4	2	—	—	1	—	—	—	—	—	22	12
Total	519	518	81	98	23	18	53	66	5	7	73	100	754	807
Schools not accredited														
Arkansas	7	9	—	—	—	—	—	—	—	—	—	—	7	9
Connecticut	3	6	—	—	—	—	—	5	—	—	—	—	3	11
Mich. Mining	15	19	—	—	—	—	—	—	—	—	—	—	15	19
Mississippi	2	3	—	—	—	—	—	—	—	—	—	—	2	3
New Hampshire	4	6	—	—	—	—	3	4	—	—	—	—	7	10
Oklahoma	11	18	—	—	—	—	—	—	—	—	—	—	11	18
Rutgers	2	4	—	—	—	—	—	—	—	—	—	—	2	4
Texas (S.F. Austin)	5	6	—	—	—	—	—	—	—	—	—	—	5	6
Univ. of South	3	5	—	—	—	—	—	—	—	—	—	—	3	5
Virginia Poly. Ins.	5	8	—	—	—	—	—	—	—	—	—	—	5	8
Washington State	8	9	—	—	2	—	4	2	—	—	—	—	14	11
Total	65	93	—	—	2	—	7	11	—	—	—	—	74	104
Grand total	584	611	81	98	25	18	60	77	5	7	73	100	828	911

those classes would be virtually impossible.

The same five broad classes used for the past three years have been used again this year. These are *General Forestry*, *Wood Technology and Utilization*, *Range Management*, and *Forest Recreation*. Those curricula falling out of these broad classes have been grouped under the heading *Others*.

While each of these classes was described for 1953 (Jour. Forestry 52:354-358) and 1954 (Jour. Forestry 53:256-261), they are being repeated for clarity. The statistics grouped together under the heading of *General Forestry* cover those phases of forestry dealing with the growing and harvesting of forest crops. The primary emphasis is placed on the production of the crop and the management of the forest land. Not included are such curricula as "Conservation." In the graduate field specialization in the fields of forest soils, silviculture, mensuration, protection, economics, valuation, and regulation are included. Since logging (logging engineering and forest engineering) is a phase of harvesting it has been included under this heading.

The statistics grouped together under the heading of *Wood Technology and Utilization* cover those phases which, though tied to the production of the crop, are concerned primarily with the wood itself and its utilization. Not included are specialized curricula in chemical utilization, plastics, pulp and paper manufacturing, furniture manufacturing, packaging and similar specializations. These have been grouped under *Others* along with Conservation Education, Rural Land Use Planning, Landscape Gardening, Soil Conservation, Light Construction and Lumber Merchandising. *Range Management*, *Wildlife Management*, *and Forest Recreation* are terms which should be self-explanatory.

Degrees Granted

During the calendar year 1956 the 37 schools of forestry awarded an estimated 911 undergraduate degrees, 226 master degrees, and 35 doctor degrees. Of the undergraduate degrees 807 or 88 percent

TABLE 3.—MASTER DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1955 AND 1956

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956
Alabama	—	—	1	—	—	—	—	—	—	—	—	—	1	—
California	3	7	—	—	—	1	—	—	—	—	—	—	3	8
Colorado	4	—	—	—	3	2	3	5	—	1	1	—	11	8
Duke	16	13	1	5	—	—	—	—	—	—	—	—	17	18
Florida	—	1	—	—	—	—	—	—	—	—	—	—	—	1
Georgia	2	7	—	—	—	—	—	1	—	—	—	—	2	8
Idaho	3	4	1	1	3	3	—	3	—	—	1	—	8	11
Iowa	1	1	—	3	—	—	—	—	—	—	—	—	1	4
Louisiana State	—	2	—	—	—	—	1	2	—	—	—	—	1	4
Maine	—	1	—	—	—	—	2	—	—	—	—	—	2	1
Massachusetts	—	—	—	—	—	—	2	2	—	—	—	—	2	2
Michigan State	6	6	3	1	—	—	6	4	2	—	4	—	21	11
Michigan Univ.	5	16	3	—	—	—	—	6	—	—	7	9	15	31
Minnesota	3	5	1	—	—	—	—	—	—	—	—	—	4	5
Missouri	—	2	—	—	—	—	—	—	—	—	—	—	—	2
Montana	8	2	—	—	—	—	—	—	—	—	—	—	8	2
New York	10	17	8	12	—	—	—	—	—	—	2	9	20	38
North Carolina	5	4	4	4	—	—	—	—	—	—	—	—	9	8
Oregon	4	7	—	1	—	—	—	—	—	—	—	—	4	8
Pennsylvania	3	4	1	3	—	—	1	—	—	—	—	—	5	7
Purdue	1	3	—	2	—	—	1	—	—	—	1	1	3	6
Utah State Col.	2	5	—	—	4	1	11	5	—	—	—	—	17	11
Washington Univ.	3	5	—	—	—	—	—	—	—	—	—	—	3	5
Yale	27	22	7	2	—	—	—	—	—	—	—	—	34	24
Total	106	134	30	34	10	7	27	28	2	1	16	19	191	223
Schools not accredited														
New Hampshire	—	2	—	—	—	—	—	—	—	—	—	—	—	2
Virginia Poly.	—	—	—	—	—	—	1	1	—	—	—	—	1	1
Washington State	—	—	—	—	—	—	2	—	—	—	—	—	2	—
Total	—	2	—	—	—	—	3	1	—	—	—	—	3	3
Grand total	106	136	30	34	10	7	30	29	2	1	16	19	194	226

TABLE 4.—DOCTOR DEGREES GRANTED FOR COMPLETION OF STUDIES IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES—CALENDAR YEARS 1955 AND 1956

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956
California	2	1	—	—	—	1	—	—	—	—	3	2	5	4
Duke	2	2	—	—	—	—	—	—	—	—	—	—	2	2
Iowa	1	1	—	—	—	—	—	—	—	—	—	—	1	1
Michigan State	3	2	2	—	—	—	—	4	—	—	—	—	5	6
Michigan Univ.	2	—	—	1	—	—	—	1	—	—	1	2	3	4
Minnesota	—	1	—	—	—	—	—	—	—	—	—	—	—	1
New York	3	2	7	7	—	—	—	—	—	—	—	—	10	9
Utah	—	—	—	—	—	1	—	1	—	—	—	—	—	2
Washington Univ.	—	3	—	—	—	—	—	—	—	—	—	—	—	3
Yale	3	2	1	—	—	—	—	—	—	—	—	—	4	2
Total	16	14	10	8	—	2	—	6	—	—	4	4	30	34
Schools not accredited														
Virginia Poly.	—	—	—	—	—	—	1	1	—	—	—	—	1	1
Grand total	16	14	10	8	—	2	1	7	—	—	4	4	31	35

TABLE 5.—ENROLLMENT BY CLASSES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1956-57

Accredited schools	Freshmen	Sophomore	Junior	Senior	Total undergraduates	Graduates Masters	Graduates Doctors
Alabama	66	34	28	28	156	2	—
California	16	23	43	43	125	20	9
Colorado	254	99	89	70	512	20	—
Duke	—	—	—	—	—	28	9
Florida	45	30	16	16	107	7	—
Georgia	62	58	66	66	252	2	—
Idaho	69	84	50	47	250	20	—
Iowa	64	44	39	35	182	9	4
La. Poly. Inst.	50	15	29	14	108	—	—
Louisiana State	59	24	26	28	137	15	—
Maine	76	66	39	31	212	4	—
Massachusetts	19	36	17	27	99	7	—
Michigan State	160	170	187	151	668	52	16
Michigan Univ.	22	28	42	47	139	42	33
Minnesota	80	86	61	44	271	11	7
Missouri	33	47	41	31	152	1	—
Montana	73	81	88	52	294	8	—
New York	160	154	101	113	528	54	38
North Carolina	94	80	52	52	278	16	4
Oregon	64	101	85	69	319	9	—
Pennsylvania	114	70	70	57	311	17	—
Purdue	49	40	27	42	158	9	3
Utah	114	103	64	40	321	25	10
Washington Univ.	89	63	63	49	264	10	9
West Virginia	76	34	27	35	172	—	—
Yale	—	—	—	—	—	37	18
Total	1,908	1,570	1,350	1,187	6,015	425	160
Schools not accredited							
Arkansas	35	31	24	12	102	—	—
Connecticut	17	17	16	11	61	—	—
Mich. Mining	27	31	20	34	112	—	—
Mississippi	53	40	31	17	141	—	—
New Hampshire	18	21	19	8	66	—	—
Oklahoma	24	24	36	37	121	1	—
Rutgers	20	15	4	4	43	—	—
Texas (S.F. Austin)	44	18	9	6	77	—	—
Univ. of South	25	6	4	4	39	—	—
Virginia Poly. Inst.	23	11	7	18	59	4	4
Washington State	26	23	29	19	97	—	1
Total	312	237	199	170	918	5	5
Grand total	2,220	1,807	1,549	1,357	6,933	430	165

TABLE 6.—UNDERGRADUATE FALL TERM ENROLLMENTS BY CLASSES IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1944-1945 THROUGH 1956-1957

Academic years	—Freshmen— Enrollment	Change	—Sophomores— Enrollment	Change	—Juniors— Enrollment	Change	—Seniors— Enrollment	Change	—Totals— Enrollment	Change
1944-1945	321	+ 122	114	+ 20	64	— 37	72	— 37	571	+ 68
1945-1946	840	+ 519	315	+ 201	205	+ 141	113	+ 41	1,473	+ 902
1946-1947	3,611	+2,771	1,840	+1,525	914	+ 709	645	+ 532	7,010	+5,537
1947-1948	2,061	—1,550	2,878	+1,038	1,577	+ 663	938	+ 293	7,454	+ 444
1948-1949	1,851	— 210	2,178	— 700	2,497	+ 920	1,686	+ 748	8,212	+ 758
1949-1950	1,485	— 366	1,667	— 511	1,816	— 681	2,501	+ 815	7,469	— 743
1950-1951	1,442	— 43	1,379	— 288	1,384	— 432	1,730	— 771	5,935	—1,534
1951-1952	1,370	— 72	1,107	— 272	1,053	— 331	1,269	— 461	4,799	—1,136
1952-1953	1,536	+ 166	1,012	— 95	1,013	— 40	1,130	— 139	4,691	— 108
1953-1954	1,698	+ 162	1,168	+ 156	917	— 96	1,126	— 4	4,909	+ 218
1954-1955	1,986	+ 288	1,377	+ 209	1,032	+ 115	962	— 164	5,357	+ 448
1955-1956	2,149	+ 163	1,566	+ 189	1,236	+ 204	1,087	+ 125	6,038	+ 681
1956-1957	2,220	+ 71	1,807	+ 241	1,549	+ 313	1,357	+ 270	6,933	+ 895

TABLE 7.—ENROLLMENT OF JUNIOR AND SENIOR STUDENTS IN SPECIALIZED FIELDS AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1956-57

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.
Alabama	28	28	—	—	—	—	—	—	—	—	—	—	28	28
California	42	42	—	—	1	1	—	—	—	—	—	—	43	43
Colorado	21	18	10	13	21	10	26	15	11	14	—	—	89	70
Florida	14	15	—	1	—	—	2	—	—	—	—	—	16	16
Georgia	57	57	—	—	—	—	9	9	—	—	—	—	66	66
Idaho	32	29	9	7	5	4	1	4	—	—	3	3	50	47
Iowa	26	16	10	16	3	3	—	—	—	—	—	—	39	35
La. Poly. Inst.	29	14	—	—	—	—	—	—	—	—	—	—	29	14
Louisiana State	20	27	—	—	—	—	6	1	—	—	—	—	26	28
Maine	28	23	—	—	—	—	11	8	—	—	—	—	39	31
Massachusetts	12	20	—	—	—	—	5	7	—	—	—	—	17	27
Michigan State	49	27	2	6	—	—	27	20	7	9	102	89	187	151
Michigan Univ.	22	27	2	4	—	—	8	12	—	—	10	4	42	47
Minnesota	32	28	1	3	—	—	19	7	—	—	9	6	61	44
Missouri	33	26	—	—	—	—	—	—	—	—	8	5	41	31
Montana	69	36	7	4	6	6	6	6	—	—	—	—	88	52
New York	39	60	26	28	—	—	—	—	—	—	36	25	101	113
North Carolina	30	33	10	9	—	—	—	—	—	—	12	10	52	52
Oregon	72	61	13	8	—	—	—	—	—	—	—	—	85	69
Pennsylvania	61	50	9	7	—	—	—	—	—	—	—	—	70	57
Purdue	22	37	5	5	—	—	—	—	—	—	—	—	27	42
Utah	24	10	—	—	22	13	18	17	—	—	—	—	64	40
Washington Univ.	51	39	12	10	—	—	—	—	—	—	—	—	63	49
West Virginia	19	21	5	8	—	—	3	6	—	—	—	—	27	35
Total	832	744	121	129	58	37	141	112	18	23	180	142	1,350	1,187
Schools not accredited														
Arkansas	24	12	—	—	—	—	—	—	—	—	—	—	24	12
Connecticut	11	8	—	—	—	—	5	3	—	—	—	—	16	11
Mich. Mining	20	34	—	—	—	—	—	—	—	—	—	—	20	34
Mississippi	31	17	—	—	—	—	—	—	—	—	—	—	31	17
New Hampshire	11	6	—	—	—	—	8	2	—	—	—	—	19	8
Oklahoma	36	37	—	—	—	—	—	—	—	—	—	—	36	37
Rutgers	4	4	—	—	—	—	—	—	—	—	—	—	4	4
Texas (S.F. Austin)	9	6	—	—	—	—	—	—	—	—	—	—	9	6
Univ. of South	4	4	—	—	—	—	—	—	—	—	—	—	4	4
Va. Poly. Inst.	7	16	—	—	—	—	—	2	—	—	—	—	7	18
Washington State	20	12	—	—	4	—	5	6	—	—	—	1	29	19
Total	177	156	—	—	4	—	18	13	—	—	—	1	199	170
Grand total	1,009	900	121	129	62	37	159	125	18	23	180	143	1,549	1,357

were awarded by the accredited schools, compared to 754 or 91 percent in 1955; 858 or 90 percent in 1954; 903 or 85 percent in 1953; and 1,095 or 86 percent in 1952.

Looking at the breakdown of the undergraduate degrees in the specialized fields, we find that 611 of the 911 degrees granted, or 67 percent, were in the field of *General Forestry*. This compares to 71 percent in 1955; 67 percent in 1954; 72 percent in 1953; and 71 percent in 1952 (Table 2).

Wood Technology and Utilization ranked second with 11 percent and *Wildlife Management* followed with approximately 8½ percent. Nearly 11 percent of the degrees granted in 1956 were classified as *Others*, compared to 9 percent in both 1955 and 1954, 7 percent in 1953 and 5 percent in 1952. The latter figures would indicate a growing interest in unclassified curricula.

The number of master degrees conferred in 1956 showed an increase from 194 to 226 or 16 percent. This is, however, the same number as granted in 1952. *General Forestry* accounted for the largest number, 136 or 60 percent. *Wood Technology and Utilization* ranked second with 34 or 15 per-

TABLE 8.—FALL TERM ENROLLMENT OF WOMEN IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE YEARS 1943 THROUGH 1956

	Freshmen	Sophomore	Junior	Senior	Total under graduates	—Graduates— Masters	Doctors
1943	2	—	1	4	7	—	—
1944	5	5	—	1	11	1	—
1945	5	6	5	—	16	1	—
1946	5	5	4	4	18	—	1
1947	1	1	3	4	9	—	—
1948	1	3	1	4	9	2	—
1949	1	1	2	2	6	1	—
1950	2	—	1	4	7	1	1
1951	—	4	—	1	5	—	1
1952	5	2	3	—	10	1	1
1953	8	5	—	3	16	—	—
1954	7	6	3	1	17	2	—
1955	4	5	6	3	18	5	1
1956	8	3	5	4	20	4	5

TABLE 9.—ENROLLMENT OF GRADUATE STUDENTS IN SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE FALL TERM 1956-57

Accredited schools	General forestry		Wood technology		Range management		Wildlife management		Forest recreation		Others		Totals	
	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Ms.	Dr.	Mr.	Dr.	Ms.	Dr.	Ms.	Dr.
Alabama	2	—	—	—	—	—	—	—	—	—	—	—	2	—
California	14	4	—	—	2	2	—	—	—	—	4	3	20	9
Colorado	3	—	—	—	1	—	12	—	4	—	—	—	20	—
Duke	24	8	4	1	—	—	—	—	—	—	—	—	28	9
Florida	5	—	1	—	—	—	1	—	—	—	—	—	7	—
Georgia	—	—	—	—	—	—	2	—	—	—	—	—	2	—
Idaho	5	—	—	—	4	—	8	—	—	—	3	—	20	—
Iowa	5	3	4	1	—	—	—	—	—	—	—	—	9	4
La. State Univ.	10	—	—	—	—	—	5	—	—	—	—	—	15	—
Maine	2	—	—	—	—	—	2	—	—	—	—	—	4	—
Massachusetts	—	—	—	—	—	—	7	—	—	—	—	—	7	—
Michigan State	16	6	2	3	—	—	11	7	2	—	21	—	52	16
Michigan Univ.	17	8	4	1	—	—	3	5	—	—	18	19	42	33
Minnesota	4	5	3	—	—	—	—	—	—	—	4	2	11	7
Missouri	1	—	—	—	—	—	—	—	—	—	—	—	1	—
Montana	6	—	1	—	—	—	1	—	—	—	—	—	8	—
New York	29	11	17	27	—	—	—	—	—	—	8	—	54	38
North Carolina	4	—	11	4	—	—	—	—	—	—	1	—	16	4
Oregon	7	—	2	—	—	—	—	—	—	—	—	—	9	—
Pennsylvania	9	—	6	—	—	—	2	—	—	—	—	—	17	—
Purdue	5	1	1	1	—	—	—	1	—	—	3	—	9	3
Utah	4	—	—	—	12	3	9	7	—	—	—	—	25	10
Washington Univ.	7	8	3	1	—	—	—	—	—	—	—	—	10	9
Yale	29	12	8	6	—	—	—	—	—	—	—	—	37	18
Total	208	66	67	45	19	5	63	20	6	—	62	24	425	160
Schools not accredited														
New Hampshire	1	—	—	—	—	—	—	—	—	—	—	—	1	—
Va. Poly. Inst.	—	—	—	—	—	—	4	4	—	—	—	—	4	4
Washington State	—	—	—	—	—	—	—	1	—	—	—	—	—	1
Total	1	—	—	—	—	—	4	5	—	—	—	—	5	5
Grand total	209	66	67	45	19	5	67	25	6	—	62	24	430	165

TABLE 10.—NUMBER OF DEGREES GRANTED FOR COMPLETION OF STUDIES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE CALENDAR YEARS 1900-1956

Years	Undergraduate degrees	Masters's degrees	Doctor's degrees
1900	1	—	
1901	5	—	
1902	2	9	
1903	3	14	
1904	9	29	
1905	9	34	
1906	24	24	
1907	19	27	
1908	31	35	
1909	47	44	
1910	61	48	
1911	100	61	
1912	122	54	
1913	136	37	
1914	151	42	
1915	124	35	
1916	151	36	
1917	160	27	
1918	65	10	
1919	53	6	
1920	160	25	
1921	126	26	
1922	141	44	
1923	217	31	
1924	215	43	
1925	280	44	
1926	259	58	
1927	263	50	
1928	302	64	
1929	291	54	
1930	308	69	
1931	394	97	(34)[1]
1932	380	78	7
1933	355	65	6
1934	337	47	6
1935	423	58	8
1936	502	67	9
1937	803	75	7
1938	980	95	5
1939	1,102	112	8
1940	1,072	105	9
1941	834	117	12
1942	654	76	13
1943	446	28	6
1944	106	12	3
1945	51	18	7
1946	192	65	8
1947	553	223	7
1948	918	222	16
1949	1,443	205	12
1950	2,321	275	29
1951	1,564	267	21
1952	1,267	226	25
1953	1,045	151	37
1954	957	179	44
1955	829	194	31
1956	911	226	35
Total	24,274	4,363	405

[1]Total doctor's degrees granted prior to 1932. Break-down by years not available.

cent and *Wildlife Management* third with 29 or 13 percent. Of the 226 master degrees granted, 223 were granted by the accredited schools (see Table 3).

The number of doctor degrees granted increased from 31 to 35, but was still considerably below the all-time high of 44 granted in 1954. Again the largest number were in *General Forestry* and with the exception of one in wildlife all were granted by accredited schools (see Table 4).

Undergraduate Enrollment

From 1948 to 1952 the undergraduate enrollment declined from 8,212 to 4,691. In 1953 it increased to 4,909. This was an increase of 5 percent. In 1954 there was an increase of 9 percent and in 1955 11 percent. The increase this year was 14.8 percent, increasing from 6,038 to 6,933 (see Tables 5 and 6). The increase this year is brought about by an increase in all classes. However, the increase in the fresh-

man class has been declining for each of the past two years. By analyzing the freshman, sophomore, and junior statistics (see Table 6) it seems evident that the upper classes are augmented by transfers from other curricula, from junior colleges, and/or from other institutions.

Looking at the breakdown by specialized curricula we find that 65 percent of the junior and 66 percent of the senior enrollment was accounted for by those majoring in *General Forestry* (see Table 7). These percentages are almost identical with those last year (i.e., junior 65 percent, senior 67 percent). These percentages also approximate the percentage of degrees granted in *General Forestry;* i.e., 67 percent in 1956; 71 in 1955; 67 in 1954; 72 in 1953 and 71 in 1952. In other words, *General Forestry*, which has accounted for two-thirds of the bachelor degrees in the past five years, should continue to do so for at least the next two.

Wood Technology and Utilization accounted for 8 percent of the junior and 9 percent of the senior, compared to 10 percent in each class last year. *Wildlife Management* totalled 10 and 9 percent respectively, and *Range Management* 4 and 3 percent respectively.

The trends in enrollment are confused by the transfer of students from other institutions and curricula. Last year trends indicated an increase this year of something over 10 percent; which totalled approximately 15 percent. Analyzing the enrollment trends of the past two years an increase of 12 percent is indicated for the next year. This would mean a total enrollment of approximately 7,800.

The enrollment of undergraduate women students continues small, totalling only 20, compared to 18 last year and 17 the year before (see Table 8).

Graduate Enrollment

The graduate enrollment is confined to 24 accredited and 3 non-accredited schools. The enrollment in the accredited schools accounts for 425 of the 430 master candidates and 160 of the 165 doctor candidates. Among the accredited schools 208 of the 425 master candidates were enrolled in *General Forestry* (47 percent); 67 in *Wood Technology and Utilization* (16 percent); 63 in *Wildlife Management* (15 percent); and 19 in *Range Management* (4 percent).

The enrollment for the doctorate in the accredited schools shows 66 (41 percent) in *General Forestry*, 45 (28 percent) in *Wood Technology and Utilization*, and 20 (12 percent) in *Wildlife Management*.

Of the 595 graduate students enrolled throughout the nation only 9 are women, 4 candidates for the master degree and 5 for the doctorate (see Table 8).

Forests of the Mississippi Delta

Commercial forest land area has declined by 12 percent or nearly 1,500,000 acres during the past 20 years in the Mississippi Delta, chiefly because of extensive clearing for agriculture. This was revealed in a report issued recently by the Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture.

The report presents the principal findings of that part of the nationwide Forest Survey conducted in the Mississippi River Delta between 1947 and 1954. The results of an earlier survey, made in the mid-1930's, were also drawn upon to show changes in forest conditions during the intervening years. As used in the report, the "Delta" refers to the entire flood plain of the Mississippi River in Arkansas, Louisiana, and Mississippi; not merely to the alluvial deposit at the mouth of the River.

Ranging in width from 30 to 120 miles, the Delta encompasses a total land area of some 28 million acres. At the time of reinventory, commercial forests covered 10,500,000 acres, or 38 percent of the total land area.

Delta forests support 25 billion board feet of hardwood sawtimber and nearly 4 billion of softwood. The chief hardwoods include oak, hickory, sweetgum, cottonwood, willow, and tupelo. Cypress is the only softwood of importance, although pines are found in restricted localities.

The net change in sawtimber volume during the past two decades amounted to a 14 percent decrease, the Survey found. This decline was felt in all of the Delta except south Louisiana. In Louisiana's South Delta, sawtimber volume registered a 23-percent increase.

For the Delta as a whole, timber is now growing faster than it is being cut. But all indications suggest that both the quantity and quality of the annual increment of the forest is far below capacity.

A full report of the Survey may be secured from the Southern Forest Experiment Station, 2026 St. Charles Avenue, New Orleans 13, Louisiana, or at its Delta Research Center, Stoneville, Mississippi.

Collection, Shipping, and Storage of Slash and Loblolly Pine Cuttings

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THE PROPER handling of scion material prior to grafting is critical to the success of a large scale propagating program. Special difficulties are encountered when material is collected at a distance that will necessitate several days in transit to the nursery for grafting.

In the first year of grafting slash and loblolly pines at the University of Florida, for our cooperative seed-orchard program with industry, we had less than 9 percent success. Many of the failures were directly attributable to the improper handling of the scion material both prior to and during shipment. On the basis of these experiences we were able to develop a method for the shipping and handling of cuttings which permitted us to achieve successes of 60 to 92 percent in making more than 4,000 grafts during the past year.

Initial Observations

Observations made the first year, when cuttings were shipped in wet sphagnum moss and enclosed in polyethylene containers, indicated that fermentation in shipment was killing the scion material. Bundles of cuttings from the post office had internal temperatures of more than 125 degrees F. Often the needles of the scions were blackened from heat and excessive moisture and were obviously dead on arrival. At first we were inclined to accuse the much maligned Postal Department of storing the material next to the classical steampipe. However, further investigation of the packages indicated the high temperature and mortality were the results of fermentation within the bundle. The scion material was being killed by care rather than neglect. In their anxiety to prevent dehydration in shipment, cooperators were bundling the cuttings in wet sphagnum moss and placing the bundles in tightly sealed polyethylene bags. Whenever more than a few hours were required for shipment the procedure invariably resulted in the death of the cuttings.

Consultation with men who specialize in the shipping of fresh vegetables and flowers indicated that a compromise between air circulation and high humidity is required for successful shipment and storage of plant materials. Apples, citrus, sweet corn, and other vegetables are adversely affected when confined in storage rooms or airtight containers (*4, 5*). In various plastic-film containers, even those purported to be permeable to gases, carbon-dioxide concentrations reach levels of 20 to 40 percent in less than five days at tempertures of 38 degrees F. The CO_2 concentration of the atmosphere within tightly packaged sweet corn increased to over 30 percent in less than twenty-four hours when stored at room temperature (*2, 3*).

In the above cases the oxygen concentration falls to less than 1 percent and complete anaerobic conditions are approached. Respiration stops and fermentation sets in, producing odorous gases and other effects that spoil the fruit.

The above observations provide the basis for the practice of perforating the plastic packages in which vegetables are sold. The plastic hinders excessive transpiration and evaporation from the plant material and perforations permit sufficient air circulation to prevent fermentation and accumulation of noxious gases. Ventilation of the master carton is also essential for adequate circulation of air about the plant material. Shippers of fresh fruits and vegetables therefore use perforated outer boxes in addition to perforation of primary film wrappers.

The importance of controlling respiration by keeping the temperature of the scion packages low during shipment is emphasized by another observation from horticulture. Sugar content in sweet corn is best maintained at low temperatures and precooling of packaging material is therefore critical. Corn and other vegetables are packaged and shipped at temperatures of less than 40 degrees F. The sugar content of corn, when packaged and shipped at room temperature, falls off so the corn loses its palatability in less than twenty-four hours (*2*).

Conifer seedlings (*Pinus ponderosa, Abies procera, Picea sitchensis, Pseudotsuga menziesii* var. *menziesii*) were stored successfully for more than eight months at temperatures between 33 and 35 degrees F. with humidity between 95 and 100 percent (*1*). Dehydration of the seedlings is a problem at temperatures below 33 degrees F. and mold attacks the seedlings at temperatures above 35 degrees F. The seedlings dehydrate when stored at relative humidities of less than 95 percent.

Recommended Shipping and Storage Procedure

The following procedures for handling scion were evolved from our experience in 1955, plus the information obtained from the literature cited in the preceding sections.

Cuttings are usually shot down with a high-powered 22 rifle and immediately taken into the shade where they are wrapped. Water from the scions condenses quickly in the polyethylene container and the resulting droplets will act as burning glasses if the package is exposed to the sun. Cuttings are placed in the polyethylene bag with a loose mixture of dry sphagnum moss. The moss serves to separate the cuttings from each other and permit air passage amongst the cuttings. A single handful of

sphagnum moss is immersed in water until soaked and then squeezed as dry as possible. The resulting wad of moist moss is thrown into one corner of the bag and serves the same function as the humidifier in a tobacco humidor. The evaporation from the moist sphagnum ball permeates the entire container and maintains a 100 percent relative humidity. Care must be taken not to crowd too many cuttings into a single polyethylene bag. Use large bags. We purchase the turkey-size polyethylene freezer bags from the local hardware and department stores. (Where we use these bags in quantities of 500 or more we purchase them direct from the manufacturer.) We tie the open end of the bag shut with a string and then perforate the bag with from 15 to 20 holes by punching with the end of a pencil or sharpened stick. The bundle is marked with the all-important label both inside and out and placed in a perforated box, which permits ventilation from the outer atmosphere.

The resulting package is kept as cool as possible during all subsequent stages of handling. When shipment has to be made by automobile, care must be taken to avoid leaving the plants in the tightly closed trunk or passenger section of the car. The packages should be kept clear of the floor if there is a tendency for heating. Wherever reasonably possible, cuttings should be shipped in an iced box, particularly in the summertime when high temperature conditions prevail. Where shipment can be made in a refrigerated container (such as a portable ice box) avoid having the plant material fall into the water and keep the package free from direct contact with the ice. The needles of slash pine scions become chlorotic and die when they are immersed, or directly touch the ice, for long periods.

Observations in 1956

When cuttings were taken in the manner described and properly packed and shipped, we achieved a grafting success of 60 to 92 percent, depending upon the season of grafting. Successful grafts fell to less than 30 percent in summer work. Scion material has been successfully shipped from Australia in packages of the type described. Australian shipments require 10 days in transit. Packages of cuttings wrapped in the prescribed manner were stored in a 30 to 40 degree F. coldroom for more than four months, and successful grafts were obtained using this stored material. Care is taken during storage to see that the packages are turned regularly so that there is adequate air circulation about the stored material. Although a reasonable success is obtained in grafting with stored scion wood we find that prompt grafting of the scion material after the cuttings are taken from the selected tree is essential to a high degree of success. Therefore, the shipping and storing time should be kept to a minimum.

The importance of correct packaging and shipment and the importance of prompt use of scion material was emphasized during the month of January, 1956. During this period our grafting success was unusually high. With scions that were fresh and properly handled 903 of a total of 1,054 grafts lived, a success of 86.8 percent. During this same period one cooperator did not wrap his scions as instructed but, instead, simply placed them in the trunk of his car and brought them to us. Fortunately, delivery was prompt and the weather cool and moist. In spite of these favorable factors only 148 of the 199 grafts made with this material lived, a success of only 74.3 percent. During this same period another lot of 304 scions had to be stored for one week and only 246, or 80.7 percent, of the grafts made with the stored scions were successful. The percent of successful grafts was lower for both of these lots of scions than the success attained with any other scion shipments received and grafted during the same period.

Summary

Handling of scion material prior to the actual time of grafting is critical to success. Experience in the handling and shipping of cuttings and a technique for shipping and storing cuttings is described. With proper control of temperature, humidity, and atmosphere successful grafts have been made with cuttings shipped to Florida from Australia and with cuttings stored for more than four months.

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Some Economic Characteristics of the Pacific Coast Softwood Plywood Industry

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THE FIRST SOFTWOOD plywood panels were produced by hand in 1905 to be displayed as a novelty at the Lewis and Clark Exposition at Portland, Oregon. The industry grew slowly in the years before World War II, but in the postwar period it has had one of the most phenomenal rates of expansion in the wood products field. Today softwood plywood is produced in over one hundred highly mechanized plants in five western states. The industry employs over thirty thousand men and women, and its investment in plant and equipment is in excess of one quarter billion dollars. Softwood plywood production has become big business in the Douglas-fir regions of the Pacific Coast states.

Organization of the Industry

Components of output.—Nearly all of the mills in the industry produce Douglas-fir plywood. Douglas-fir is the most common softwood species used for plywood because of its relative abundance and its favorable characteristics for peeling. Other species used include pine, redwood, spruce, white fir, western larch, hemlock, western redcedar, and noble fir.

A recent innovation in the industry has been the veneer or green-end mill. These mills, which produce veneer but do not lay it up into plywood, account for about one fourth of the veneer used in the industry. The output of these mills supplements the veneer production of plywood mills in areas where timber is scarce. A few lay-up plywood mills do not have lathes or clippers and depend entirely on green-end mills for veneer.

Some mills produce panels with fir cores and hardwood faces. Hardwoods used include birch, Philippine mahogany, cottonwood, maple, oak, walnut, tanoak, myrtlewood, alder, and madrone. A few firms operate hardwood plants in conjunction with their plywood mills. In recent years many mills have produced specialty items such as brushed panels, striated panels, embossed panels, and plywood overlaid with paper or plastic.

Location of plants.—The most important plywood producing state is Oregon, which accounts for about half of the industry's output. Washington is second with approximately one third of the industry's installed capacity. California is the third important plywood producing state, and Idaho, Montana, and Alaska each have at least one mill.

The early growth of the industry was in Washington, where great stands of old-growth Douglas-fir trees were easily accessible. But during the past few decades these stands have been heavily logged and the economic center of gravity of the industry has shifted southward. Southern Oregon and northern California have become more important producing areas because of their relative abundance of timber. This southward movement has been especially pronounced since 1949 when postwar building restrictions were relaxed. Since then most of the industry's expansion in output has come from new mills constructed in the southern area.

Firm characteristics.—Softwood plywood firms may be categorized according to their method of financing and the nature of the product or service rendered. The majority of firms are conventionally financed (i.e., through the sale of capital stock or by individual or family funds). About one fourth of the firms in the industry are financed by the workers who operate the plant.[1] Over half of the firms in the industry are independent operations in the sense that their main business activity is the production of softwood plywood. There are a few large multi-product firms which operate plywood mills in conjunction with other wood product plants at integrated millsites. And two firms are primarily marketing organizations, although they are among the largest plywood manufacturers.

All firms producing softwood plywood have production and marketing problems in common, but there is some divergence in their economic interests due to these differences in financing and product and service mix.

The independent firms are conventionally financed. Since they typically are not horizontally or vertically integrated, the profits of these firms are primarily dependent on the margin between manufacturing costs and the mill net price of softwood plywood. These firms must buy the bulk of their timber on the open market and hire labor at union rates. Since these factors of production tend to be somewhat inflexible in price, these firms are particularly sensitive to changes in the mill price of softwood plywood. Their economic motivation is straight-forward and in accordance with the traditional view of business incentives. This motivation might be paraphrased

[1]The worker-owned mill movement in the softwood plywood industry is almost unique in American business. It is not likely to expand to other industries because the circumstances which fostered it are uncommon. The most important of these is the very low ratio of capital to labor in plywood manufacturing.

as "profit maximization through efficiency in production."

Firms which are integrated operations such as the Weyerhaeuser Timber Company are among the largest wood products manufacturers in the world. These firms group several wood product mills at various millsites which are supplied with raw materials from forest lands which they own. They produce a broad range of products, some of which they distribute through their own wholesale and retail outlets. Softwood plywood production makes up a relatively small part of their total output.

The two marketing firms, United States Plywood Corporation and Georgia-Pacific Plywood Company, account for over ten percent of the industry's output and a considerably larger percentage of its wholesale sales. They are the only firms which operate on a large scale in both the softwood and hardwood plywood industries. Both firms had considerable experience in softwood plywood distribution before they began manufacturing operations, and they still consider their main business activity to be the wholesaling of plywood and related products. In addition to their own production they market the outputs of other mills through exclusive sales contracts.

Worker-owned firms are referred to as "co-ops" in the industry, but since they are profit-making organizations they are not true cooperatives. The capital of these firms is obtained by the sale of ownership shares to a few hundred workers. Since each worker may subscribe as much as $5,000, the capital fund is usually sufficient to cover most of the costs of securing a plant and machinery. An existing plant may be purchased or a new one constructed. Working capital is sometimes obtained from distributors in exchange for a long term exclusive sales contract. Each member of the firm is limited to a single share of stock, which gives the holder a vote in stockholder meetings and the right to work in the plant. The goals of these firms are to assure owner-workers of jobs in good times and bad and to pay them as high wages as conditions permit.

Concentration of ownership.— The softwood plywood industry has a relatively unconcentrated ownership structure. Essentially, a few large multi-plant firms and some big single plant firms at the top and many medium and small sized firms at the bottom make up the industry. The four largest firms in the industry account for less than 20 percent of the total output.

Plywood Manufacturing

Production techniques. — There are two separate operations involved in making plywood. In the green-end operations the log is prepared for cutting, peeled into veneer, and clipped to the proper size. In the lay-up process the veneer is dried, patched, spliced, glued, and assembled, and pressed into plywood. Two different pressing techniques are used, cold pressing and hot pressing. The former subjects the glued veneers to pressure of from 75 to 100 pounds per square inch. The latter utilizes steam heat in addition to pressure, and it produces panels with greater resistance to water and weathering.

Production costs.—About three-quarters of the costs of making softwood plywood are variable. Log costs make up the most important component of variable costs, followed by labor costs, plant supplies, and glue. A recent survey by the Douglas Fir Plywood Association showed that for 52 plants representing over three-quarters of the industry's capacity veneer costs were 55.9 percent of variable costs, direct and indirect labor was 36.5 percent, and glue was 7.6 percent.[2] The break-even point in the industry is commonly considered to be between $70 and $80 per thousand square feet. This varies according to the price paid for logs, depreciation policy, type of panels produced, and the productive efficiency of the individual plant.

Production economies of scale.— There is no significant relationship between productive efficiency and the scale of operations in softwood plywood manufacturing.[3] This is due to the relatively fixed input-output relationships between labor and capital in the production process. Softwood plywood is produced by a straight-line production technique in which the rate of output is determined by the operating speeds of the lathe, cutter, drier, and press. In a properly run plant the capacity of each machine is in balance with the others so there is a smooth flow of raw materials through successive operations. The veneer must be manually handled, graded, and repaired between stages of the process: Whether the output of a mill is changed by running more or fewer production lines, increasing or reducing the number of shifts, or by purchasing different sized machines, the relationship between labor and machinery does not vary significantly. Large plywood mills are essentially additions of several small mills under a single roof.

While there are no significant economies of large scale in plywood production there are diseconomies of small scale. In order to produce efficiently a single lathe mill should have an output of at least 3 or 4 million square feet per month. Otherwise it will not be able to fully utilize its equipment. The most common production setups are one production line producing 3 million feet a month or two production lines producing 5 million feet. One line producing 2 million feet per month and two lines producing 4 million feet are also frequently encountered. Most plants have output capacities which are multiples of one of these arrangements.

Although there are no economies of large scale production in the

[2] Douglas Fir Plywood Association Bulletin, February, 1955.

[3] A consulting engineer with a production management firm which is retained by several softwood plywood firms told the author that the three mills with the lowest unit production costs which are serviced by his firm have monthly outputs of 3, 7, and 10 million square feet.

usual sense, pecuniary economies may be obtained by grouping a number of forest product mills at a single millsite. This arrangement makes possible the most profitable utilization of a large flow of timber. Each log can be diverted to the end product offering the highest net revenue.[4] Softwood plywood mills which are part of an integrated operation are likely to have a greater utilization of waste than isolated mills because there is enough waste from the other productive processes in addition to plywood manufacturing to make it economical to set up by-products plants. In addition, the contribution of softwood plywood mills in integrated operations to logging costs and such overhead costs as administrative salaries, power plant operation, etc., may be less than for independent mills. This will depend on technological factors and the accounting procedure used.

Productive efficiency and mechanization.—Productive efficiency has increased at a modest but steady rate throughout the industry's history. The recovery ratio—one way of measuring productive efficiency—increased from 2.18 in 1949 to 2.23 in 1953, but this probably understates the real gain because of the decline in average log quality during this period.

The productive process has been substantially mechanized but future developments in this direction seem limited. Softwood plywood is manufactured by a more or less continuous batch process. Although many people in and out of the industry have been intrigued with the idea of a continuous production process, nobody has been able to develop one that is commercially successful. The main reasons for this are the variability of the raw material the consequent need for quality control, the practice of producing on order, and the amount of hand labor necessary for patching and other operations. These factors limit the amount of mechanization and specialization which can be introduced into the manufacturing process.

The Raw Material Base of the Industry

One of the most serious problems facing the industry is the increasing demands being made on its stock of high grade raw materials. The growth and development of the industry has been based on utilization of the Douglas-fir peeler logs of the Pacific Northwest. Because the trees from which these logs are cut require several hundred years to fully develop, the potential supply of peeler logs must be considered to be relatively inelastic.

On the basis of data supplied by the U. S. Forest Service O. H. Schrader estimated in 1951 that there was 246 billion feet of old-growth Douglas-fir in the Pacific states, and 63.9 billion board feet of this total was of peeler quality.[5] In order to make an estimate of the current value of this figure the peelers consumed during the years 1951-1956 must be deducted.[6] If it is assumed that about 80 percent of the total logs used by the softwood plywood industry during this period were of peeler quality and that Schrader's estimate that sawmills annually consume about 1.5 billion board feet of peelers is accurate, this leaves less than 50 billion board feet to sustain the industry's future operations.[7] At the present rate of output the industry could operate for about two or two-and-a-half decades if old-growth peeler logs were used exclusively. This is a highly hypothetical estimate for several reasons. It assumes that all of the old-growth peelers can be made available to the softwood plywood industry. This is not the case because much of this timber is controlled by public agencies and will not be available to the industry in the near future. In addition, sawmills can be expected to consume substantial amounts of peelers to produce high grade clear lumber. Consequently, the industry's future development depends to a large extent upon its ability to expand its raw material base.

Expanding the raw material base.—Much thought and research in the industry and in agencies of the federal government have been devoted to finding ways to supplement the industry's raw material base. A number of species other than Douglas-fir have been used for veneer. But as yet they are of relatively slight importance because of inability to satisfy completely either or both of two critical requirements: (1) trees must be found in suitable size and quality stands dense enough to be economically logged; and (2) logs must have characteristics suitable for producing veneer. However, as the shortage of peelable Douglas-fir logs becomes more acute the significance of these deficiencies can be expected to diminish so that increasing amounts of softwood species other than Douglas-fir will be used. Some consumer resistance to non-Douglas-fir plywood is likely, but it should be easily overcome by proper advertising and promotion by the industry.

Second growth Douglas-fir is already being used by many mills. The U. S. Forest Service has undertaken research to determine the possibilities of improving the veneer grade from such trees by means of silviculture. But the economic feasibility of such practices cannot be determined at this time because it depends upon the competitive relationships which will exist between plywood and substitute products in the future.

[4] Some of the criteria which determine the wood product plants which utilize various logs are examined in the next section.

[5] O. H. Schrader, "The Douglas Fir Plywood Industry and Its Raw Material Supply," Western Forestry and Conservation Association: Proceedings of 42nd Annual Conference, 1951.

[6] No addition is made for growth since gross growth probably equals losses due to blowdowns, insects, fires, and decay.

[7] From the standpoint of the individual mill the total inventory of old-growth peelers has very little significance. The volume of peelers (or peelable sawlogs) in areas close enough to be logged economically and the competition in the acquisition of this timber from other plywood mills and wood products plants are the most important considerations. The shortage of raw materials has reached crisis proportions for some mills; they must import logs or veneer or go out of business.

In the postwar period the mills have increasingly been forced to utilize No. 1 and No. 2 sawlogs for veneer. The degree to which the industry can profitably utilize high grade sawlogs depends on the manufacturing requirements for veneer logs and the nature of the competition from other wood products plants in procuring such logs.

A log should meet minimum standards as to size, texture, soundness of wood, etc., if it is to peel easily and yield a satisfactory quantity and quality of veneer. These standards have been revised downward considerably in the past several years, and they can decline even more if this is required by economic conditions. However, as the quality of logs declines the plywood industry's competitive position is weakened because production costs go up and the quality of the end product goes down.

Since logs can be utilized in the manufacturing of plywood, lumber, pulp, hardboard, etc., economic conditions determine which mills they go to. Some logs are clearly meant for certain end uses, but at the margin of log grades more than one mill may be able to bid for the same log (i.e., No. 1 and No. 2 sawlogs may be used for lumber or plywood). The criteria which determine the appropriate utilization of a log are the recovery rate and cost of the productive process and the price of the end product. When these differentials are considered, each log should go to the forest product industry in which it can earn the largest marginal revenue product.[8]

[8]Marginal revenue product is defined as the total increment to gross revenue derived from the sale of the last unit. It includes any additional revenue resulting from an increase in the price of preceding units which is brought about by the sale of the marginal unit. Thus the practice of sawmills of using top quality peelers to upgrade the average quality of their lumber is not inconsistent with this statement. Since the sawmills presumably would not be able to sell their total output of lumber at as high a price as they receive without "sweetening the grades" with clears produced from high grade peelers, the marginal revenue product of such logs is considerably greater than the market value of the lumber produced from them.

As the softwood plywood industry reaches lower in the log scale for its raw materials three important disadvantages accrue which limit the movement in this direction: (1) as the quality of logs decreases the recovery rate also declines because the proportion of unusable wood goes up; (2) as the size and quality of logs decline production costs increase because of additional time needed to change logs at the lathe and the necessity for more handling, patching, and splicing; and (3) as the quality of the raw material declines the quality and market value of the end product are also lowered.

The downward movement in the log grades by softwood plywood manufacturers is marked by a squeezing together of the gap between their total revenue and total manufacturing costs. At some particular log grade this margin approximates that which sawmills could receive for the same logs. Logs of this grade are marginal since either user can realize the same net return from them. At the present time No. 2 sawlogs are the marginal logs for plywood mills and sawmills in some areas. Accurate predictions of the percentage of logs which the softwood plywood industry could profitably utilize are impossible because of shifts which will inevitably occur in the recovery rates and production costs of plywood mills and sawmills due to technological innovations and in end product prices because of changes in demand.

Plywood Distribution

The bulk of the industry's output is distributed through jobber warehouses located throughout the country. Jobbers buy directly from the mills or indirectly from sales agents representing the mills. They sell to lumber yards and other retail outlets, industrial accounts, and some large contractors.

Several changes in plywood distribution have occurred in the postwar period. An increase in the number of jobbers has emphasized price competition at the wholesale level and has stimulated research to cut handling costs. Non-price competition between jobbers has made it possible for lumber yards to depend upon them almost entirely to perform the storage function. The jobber convention of not selling direct to end users has broken down substantially in the past few years because of the profit opportunities in selling direct to large tract builders and other big end users.

Conditions of Demand

According to a recent market survey about 80 percent of all softwood plywood is used for construction purposes such as on-site building, construction components, repairs, maintenance, remodeling, etc.[9] In the postwar period the use of plywood in residential construction has greatly expanded and has accounted for much of the industry's increase in sales.

Softwood plywood's most serious competitor is lumber. Plywood is the superior building material in terms of installation costs, strength, durability, insulating qualities, resistance to splitting, and other qualities. But lumber is superior in the important dimension of cost. Consequently softwood plywood is preferred to lumber only in uses where its advantages are important enough to overcome the primary cost differential. In the postwar period increasing carpentry costs have given softwood plywood an important advantage because of its ease of installation. A great difficulty in opening new fields for plywood is the tendency of contractors to continue to use lumber because of their greater familiarity with it.

Fiber boards are potentially serious competitors for softwood plywood because they have many of the same qualities as plywood and they cost much less. However, the most important construction markets controlled by plywood cannot be entered by fiber boards

[9]A plywood market report made by the firm of Alderson and Sessions, Philadelphia, Pa., for the Douglas Fir Plywood Association, 1952.

on a large scale at the present time because of their lack of structural strength.

Foreign competition.—Imports of plywood have risen rapidly in the past several years. By 1953 imports (mainly from Japan) accounted for 6 percent of total domestic sales. This increase was due to the lower price of the imported product, which reflected the relatively lower opportunity costs of resources in foreign countries rather than a higher degree of productive efficiency. While foreign imports have increased considerably their threat has been potential rather than actual because of the prodigious growth in the demand for softwood plywood. The total market has expanded so rapidly that imports have been absorbed without serious inroads on the domestic industry's operations. Because of their location, the high quality of their product, and their experience in developing new markets, domestic manufacturers should be able to protect their position of leadership in the market.

Competitive Behavior

Since the bulk of the industry's output is inherently homogeneous and is sold primarily as an industrial good, individual manufacturers have little incentive to differentiate their products through advertising or sales promotion.[10] Competitive behavior within the industry typically takes the form of price competition.

Determination of Market Price

The short-run market price of softwood plywood is established by the interaction of a large number of buyers and sellers rather than by the administrative decisions of one or a few firms. The industry's output is produced by over one hundred firms and is sold to several hundred jobbers and other buyers who are constantly in direct or indirect contact with the mills. No single mill produces enough and no single jobber buys enough of the industry's output to be able to control the market price by their individual actions.[11] Since the industry's output is predominantly homogenous, at any moment of time there is a recognized market price for each type of panel.[12] This price is established at the level where the market is cleared (i.e., where market supply and demand curves intersect).

The market price is recognized simultaneously throughout the market.[13] This high degree of perfection of the market is due to the marketing pattern which has evolved in the industry. Most plywood mills sell the bulk of their output through sales agents and other specialized middlemen. These organizations maintain contacts with many mills in order to spread their costs of operation among as many clients as possible. Sales managers of the mills are in daily contact with a number of middlemen by telephone (market conditions change too fast to use slower means of communication). Consequently, market data is transmitted rapidly throughout the market.

Recognized and effective prices.—All sales are not necessarily made at the recognized price. Sellers always have the option to accept or reject the recognized market price. When there is a soft market and some mills are not selling all the plywood they would like at the recognized market price, they may cut their price to increase sales.[14] In effect, these mills establish an effective market price which is less than the recognized market price. Ordinarily price cuts tend to be non-standardized and freely quoted, but in prolonged periods of excess supply prices are often secretly shaded by intervals of 5 percent.[15] The gap between the recognized and the effective market price is not likely to last long because firms selling at the recognized price will lose sales. When these firms also cut their prices the recognized and effective prices are once again identical.

If demand exceeds supply at a given price competition between buyers causes the recognized market price to rise. Since price increases are seldom secret, there is no distinction between recognized and effective prices in a seller's market.

Price leadership.—Some firms typically take the lead in initiating price movements. A few of the larger firms are suspected of being price leaders in an upward direction. They act as bellwethers in the sense that other firms follow their price changes closely. This is "barometric price leadership" wherein one or a few dominant firms decide when market conditions are such that it is in the best interests of producers to demand a higher price. This type of price leadership is to be distinguished from monopoly restriction of output in order to increase price. No single firm in the softwood ply-

[10]This does not mean, of course, that the industry as a whole does not promote softwood plywood. Much of the success of the industry in entering new fields can be traced to industry-wide promotional campaigns.

[11]The marketing firms do not influence market price because of contractual agreements with the mills whose output they market. These mills are paid on the basis of the market price prevailing at the time of delivery. For this arrangement to have any meaning the marketing firms could not take the initiative in raisor lowering prices if they had such power.

[12]Eighty-five percent of the industry's total output is produced by members of the Douglas Fir Plywood Association in conformity with the U. S. Commercial Standard, and much of the other 15 percent is of comparable quality.

[13]Although there are many softwood plywood prices because of the large variety of panels produced, it is not incorrect to speak of "the price" of plywood because they all are subject to the same market forces and move together.

[14]The impetus for price cuts may come from close-dealing jobbers in periods when the order files of manufacturers are lean.

[15]Price shading occurs because the market is highly enough organized so that this activity affects market price, but it is imperfect enough so that price reductions to maintain ouput may be carried out secretly. Both the buyer and seller have nothing to gain by making price cuts public and they can expect to be the object of much ill will by other manufeturers and jobbers (i.e., mills not subject to the same economic forces as price cutters, jobbers who carry large stocks of plywood and may suffer inventory losses, etc.).

wood industry is large enough to have the latter kind of power. If the price leader's price increase were not adopted by other firms, he would have to retract it or lose most of his sales.

The worker-owned mills are often the price leaders in a downward direction. In a soft market these firms prefer to accept a lower price rather than cut back their rate of production.[16]. Since labor represents a fixed rather than a variable cost for these firms (ownership of a working share guarantees a job), their prices can be cut substantially and still exceed variable costs. Consequently, the necessary supply adjustment is forced on other firms with higher variable costs.

Other firms which are the first to cut prices in a soft market are likely to have one or more of the following four characteristics: (1) recent entrants to the industry; (2) poorly established marketing outlets; (3) inferior products; and (4) insufficient financing.

[16]This behavior is rational for an individual worker-owned mill because in a soft market by quoting a price just below the recognized price the firm maximizes its total wage bill. But when all worker-owned mills react to a decline in demand in the same way market price declines rapidly since they account for one quarter of the industry's output.

Seasonal influences on price.— The demand for plywood is highly seasonal because of the seasonality of construction, the largest single end use of plywood, and because of the marketing pattern the industry has developed. A large percentage of the industry's output is used during the months of good building weather. Jobbers place large orders in the spring to prepare for this period. When their inventories bulge in mid-summer, they stop ordering and buy cautiously throughout the fall and winter months. The mills are set up to operate on a year-around basis, but they can't produce for inventory because of shortages of warehouse space and working capital and the impossibility of predicting which of the large variety of panel types will be demanded in the future. Price shading is likely to occur in the fall and winter when jobber purchases decline.

Operation of the Industry in the Public Interest

The operation of the softwood plywood industry has been in accordance with criteria of industrial performance commonly accepted as being in the public interest. The industry has been generally characterized by a high degree of competition, and this has had a downward pressure on prices. Output expansion has been quite responsive to changes in consumer demand. During the years of its growth the industry has continually offered customers an improved product. Productive efficiency of the industry has been carried to economically feasible limits, and firms have been moderately progressive in discovering and implementing new and better production techniques. Profits have not been unduly high in view of the necessity of attracting the flow of capital necessary for the expansion in output desired by consumers. Selling costs have not been excessive because of the extremely competitive relations between agencies in the market channel at the same level and succeeding levels. The industry has performed poorly in only one dimension: conservation. Little progress has been made toward any comprehensive conservation program because of economic problems related to small size and the scattered location of most of the timberlands owned by firms in the industry. But the industry's record in this dimension has not been so bad as to alter the conclusion that on the whole the softwood plywood industry has performed well in the public interest.

Victor A. Beede (1886-1957)

Victor A. Beede died suddenly on January 13 at his home in State College, Pa. He was 70 years of age.

He was born December 9, 1886 at East Braintree, Mass. After taking the B. A. degree in 1910 at Yale University, he received the M.F. degree in 1912.

During the following five years he served as forester for the Massachusetts Forestry Association, as assistant state forester of New Hampshire, as secretary for the New York State Forestry Association, and as assistant manager for the Timberlands Mutual Fire Insurance Company.

In 1918 he entered the employ of the Brown Company in Quebec as a scaler, subsequently becoming forester in 1924.

Appointed assistant professor of forestry at the Pennsylvania State College (now University) in 1931, he was later advanced to professor of forest management, and in 1937 was named head of the Department (now School) of Forestry. He served in that capacity until his retirement in emeritus status on June 30, 1952.

Mr. Beede became a Member of the Society of American Foresters in 1918. He was also a member of the Canadian Institute of Forestry, the American Forestry Association, and the Pennsylvania Forestry Association.

Effects of Glaze on the Development of Appalachian Hardwoods

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DURING THE LAST week of January 1956, a spectacular glaze storm struck the Cheat Mountain Range in northern West Virginia. Although such storms are of regular occurrence in this area, this storm was very severe, and the ice remained on the trees for more than a week. Twigs, branches, and boles of the even-aged sapling-size hardwood stands, typical of this section, were heavily coated with ice (Fig. 1). Severe injury was restricted to stands located above 2,100 feet elevation. Fortunately, only mild winds occurred during the period when the ice was on the trees, or many stands might have been completely devastated. This paper presents the results of a survey conducted the following spring to determine the extent of damage caused by this storm.

Glaze is formed when cold rains come in contact with soil, trees, and other objects whose temperature is below the freezing point. Although glaze alone can cause extensive mechanical injury to vegetation, the greatest damage to forest trees occurs when glaze storms are accompanied by strong winds. The poor form and condition of many Appalachian hardwood stands can be traced directly to repeated damage from these storms.

Glaze may injure trees in different ways. When strong winds accompany glaze storms, many trees overturn or break off. Broken tops cause permanent crooks or forks in the bole. Heavy accumulations of ice strip twigs and branches from the trees, resulting in a reduction in growth for many years. Trees bent to the ground under the weight of ice may never straighten enough to be suitable for sawlogs. These injuries leave the trees more vulnerable to attack by insects and disease.

Species vary markedly in their resistance to glaze damage. In general, conifers suffer less than hardwoods because they have small upper crowns and branching habits better suited for supporting weight. Shallow-rooted species and trees growing in shallow soil are more apt to overturn than deep-rooted ones. Hardwoods with slender boles, large brittle branches, and large crowns are most easily broken.

Glaze damage is more severe at higher elevations. In many mountainous areas there is a definite contour below which glaze presents little problem. Although the total area hit by glaze in any one locality may be small, a strip of glaze damage, extending for hundreds of miles along a mountain range, may injure thousands of acres of timber.

In order to determine which species and crown classes were most frequently damaged, all broken trees in one 68-acre area within the glaze belt were examined and the species, crown class, and nature of the injury recorded. Yellow-poplar (*Liriodendron tulipfera* L.), chestnut oak (*Quercus prinus* L.), black cherry (*Prunus serotina* Ehrh.), and northern red oak (*Quercus rubra* L.), were most commonly broken, although some breakage was observed among sassafras (*Sassafras albidum* [Nutt.] Nees.), white oak (*Quercus alba* L.), and cucumbertree (*Magnolia acuminata* L.) Table 1 gives by crown classes the percentage of trees most often damaged. These data show that dominant and codominant trees were most frequently injured, and that intermediate and suppressed trees suffered almost no breakage (Fig. 2).

Dominant trees would be expected to be damaged most frequently, since their crowns are lo-

FIG. 1.—Glaze covering the twigs of northern red oak. The ice coating on many small twigs was 2 inches or more in diameter.

TABLE 1.—PERCENTAGE OF TREES WITH BROKEN TOPS WITHIN A 68-ACRE AREA IN THE GLAZE BELT

Species	Crown classes			
	Dominant	Codominant	Intermediate	Suppressed
Yellow-poplar	1.17	2.17	0.00	0.00
Chestnut oak	0.36	0.51	0.26	0.00
Black cherry	0.25	0.12	0.13	0.00
Northern red oak	0.12	0.05	0.00	0.00

cated above the general level of the crown canopy where they receive little or no support from neighboring trees and are directly exposed to the full force of the wind. The high percentage of broken codominant chestnut oaks occurred mainly on exposed ridges where the overmature stems had flattened, crooked tops, typical of these poor sites. The large percentage of breakage in the codominant yellow-poplar indicates that their brittle branches received insufficient support from neighboring trees to support the weight of the ice.

A large number of yellow-poplars throughout the Cheat Mountain Range show a definite crook in their butt log at a height of approximately 12 feet (Fig. 3). Several of these stems were cut and sectioned to determine whether this could be traced to breakage in a previous glaze storm. Ring counts indicate that this damage occurred during the winter of 1938-39. Meteorological records show frequent glaze storms, which might have been responsible for this damage, reported in West Virginia during that winter.

Striking injury occurred where scattered white oaks and chestnut oaks had been left from previous logging operations. The crowns of these "culls" were elevated well above the general level of the crown canopy formed by the even-aged second-growth sprout stand. Large limbs of these standards were stripped from the trunk, leaving only small branches intact. Examination of these trunks showed many old scars where previous glaze storms had removed other branches.

A dense cover of broken twigs and small branches covered the litter throughout the glaze area. Branches smaller than 3/8 inch in diameter had snapped readily under the heavy weight of the ice. Twigs of sassafras, yellow-poplar, black cherry, northern red oak, white oak, scarlet oak (*Quercus coccinea* Muenchh.), black oak (*Quercus velutina* Lam.), and red maple (*Acer rubrum* L.), were most severely damaged. Hickory (*Carya* spp.), beech (*Fagus grandifolia* Ehrh.), white pine (*Pinus strobus* L.), red pine (*Pinus resinosa* Ait.), scotch pine (*Pinus sylvestris* L.), red spruce (*Picea rubens* Sarg.), and hemlock (*Tsuga canadensis* [L.] Carr.), were not frequently damaged.

Sapling-size hardwoods bordering openings were frequently bent to the ground; however, within the stand, trees received sufficient support from neighboring trees to remain upright. Bending was most severe on the windward side of the clearings, indicating that wind had played a major role in forcing ice-laden trees to the ground. Although a majority of species righted themselves during the spring, many black cherry, red maple, white oak, northern red oak, and chestnut oak, were permanently bent and showed no signs of straightening.

In a 20-year-old red pine plantation located within the glaze belt, 17 percent of the trees had broken leaders. Most of the remaining leaders were bent just above the top whorl of branches. Observations made the following spring showed that these bent leaders were gradually straightening, and would

FIG. 2.—Dominant and codominant trees were most frequently broken. Intermediate and suppressed trees usually received sufficient support and protection from neighboring crowns to withstand the weight of the ice.

FIG. 3.—*Left*, many yellow-poplar in this region show permanent crooks in their boles which are probably due to breakage from past glaze storms. *Right*, section of bole through crook. It is evident that the bend was caused when a lateral branch took the place of the broken leader.

probably leave no permanent crook in the bole.

Crown thinning plots, established during 1954 and 1955, were studied to determine whether stands opened up by cutting were more subject to breakage then uncut stands. Trees on the heavily thinned plots were apparently much more subject to injury. The percentage of damaged trees increased with the intensity of thinning. Those stands in which less than 30 percent of the volume had been removed had suffered much less than those thinned more heavily.

Forest management practices within areas hit by frequent glaze should be designed to make stands more resistant to ice injury. Even-aged management is apparently more desirable than uneven-aged management, as the trees in even-aged stands receive beneficial support from neighboring trees, and are less likely to be broken or bent by heavy accumulations of ice.

Heavy crown thinnings open up the stand and isolate individual tree crowns, greatly increasing the danger of breakage from glaze. Frequent light crown thinnings which remove not more than 30 percent of the volume would not open the stand excessively, and would tend to strengthen the dominant and codominant trees.

Most sapling-size hardwood stands in glaze areas need a series of light improvement cuttings to remove those stems which have forks, crooks, and disease, which would lower their value for sawlogs. Where there is a ready market for small products, improvement cuttings may be made at a profit and greatly increase the future value of the stand for saw timber. However, care must be taken not to remove too much volume in any one cutting, as this isolates the remaining trees and increases their susceptibility to damage from glaze storms.

Effects of Prescribed Burning in Ponderosa Pine[1]

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PRESCRIBED burning has resulted in significant reduction in fire hazard and in silvicultural benefit in ponderosa pine stands on the Colville Indian Reservation in north-central Washington. It has been applied as part of a management system, in conjunction with slash disposal on logged-over lands. Hazard reduction is proved by comparative records of area burned, damage and cost of control from wild fires that have burned inside of and outside of treated areas over the past eleven years. Silvicultural benefits are evident from observation over the years. Photographic evidence supports such conclusions.

Prescribed burning as a thinning agent in dense ponderosa pine (*Pinus ponderosa*) reproduction stands was first tested on the Colville in October 1942. Fifth acre sample plots established in the treated area at that time, together with similar check plots on adjacent untreated areas, have been studied by the Pacific Northwest Forest and Range Experiment Station. In a preliminary report from 1949 data (*2*), the Station indicated that the burning was effective in reducing number of stems in dense thickets from 2,430 to 690 per acre. Results, however, were not uniform. Some patches were thinned too severely and others not enough. Crop trees within the treated area showed considerable increased diameter growth start when compared with crop trees from adjacent untreated areas. It was concluded that the method needs further systematic test and study of results, since it may afford a cheap, quick, wholesale method of obtaining desirable stand improvement. Studies have been continued on this area and another reproduction area burned in cooperation with the Station in 1952. It is understood that results will soon be reported on in considerable detail.

Prescribed burning techniques were utilized in spot burning of unpiled logging slash and in burning of tractor piled slash subsequent to 1942, during war and post-war years. I have already described in detail these operations that were conducted primarily for hazard reduction (*3-7* inc.). To aid in an understanding of results with which this report is concerned, it is appropriate that stand conditions and burning techniques again be briefly described.

Stand Conditions

The burning was conducted in selectively cut-over stands on extensive slash areas on several widely separated timber sale units. Mature and over-mature age classes predominated before cutting, though merchantable immature and large pole class groups were well represented. Cut per acre averaged 6,000 to 6,500 feet, board measure, with ponderosa pine comprising 75 to 90 percent of the total. Reserve stand volume averaged 3,000 board feet per acre. In Twenty Three Mile Creek Valley in the central portion of the Reservation, however, an extensive even-aged thrifty-mature ponderosa pine reserve stand averaged over 6,000 board feet per acre. Douglas-fir (*Pseudotsuga menziesii*) and western larch (*Larix occidentalis*), the most common associate species, become predominant on steeper north slopes and at elevations above 4,000 feet.

Recurrent fires have swept this forest for many centuries, the most recent extensive burns occurring in 1917, 1920, and 1926. From a fire-scarred stump section, cut on the Omak Lake Ridge in the western portion of the forest, it was found that during the period 1740 to 1920, inclusive, there was an average of one fire every eight years. Similar fire records abound over the forest.

Reproduction, before burning, was almost uniformly abundant, except on some of the areas of heavy pinegrass. Most of the openings were occupied by dense sapling and small pole size reproduction, laced by numerous pitchy, highly inflammable windfalls and snags of beetle killed trees. At lower elevations many of these reproduction groups were so dense that growth was stagnated. Douglas-fir reproduction evidenced a tendency to predominate in seedling and sapling size classes on Omak Lake Ridge, Twenty Three Mile Valley and other areas of higher elevation, between 3,000 and 4,000 feet above sea level. Poles of this species also monopolized many openings.

The Burning Operations

Prescribed burning techniques were applied in logging slash disposal because war time shortage of man-power in the woods rendered impossible hand piling and burning required by Bureau of Indian Affairs regulations. By 1943 growing expanses of unpiled logging slash together with impossibility of providing intensified protection were matters of grave

[1]This article represents the author's views and is not to be regarded as an official expression of the attitude of the Bureau of Indian Affairs on the subject discussed.

[2]The writer is indebted to Fred Rickard, forester in charge of Fire Control on the Colville Reservation and to Mrs. Betty Chin, stenographer, for time consuming and exacting computation of comparative fire data presented in Table 1, and to the Pacific Northwest Forest and Range Experiment Station for testing statistical significance of the data.

FIG. 1.—Fast growing pole stand in center and right background has fully recovered from hot slash fire during the night of October 5-6, 1943, on south slope Omak Lake Ridge. Denser portion of ponderosa pine reproduction is growing on an old logging spur.

concern to foresters responsible for protection of the Colville Indian forest. Success with the 1942 burning encouraged us to attempt reduction of extreme hazard by spot burning, despite the fact that this had always been considered inapplicable to selectively cut ponderosa pine stands.

Twenty Three Mile Valley appeared ideal for the test for ground was almost level or sloped gently and crowns of the reserve stand appeared sufficiently high to escape flames should burning be conducted under favorable conditions. Also it was hoped that burning would encourage future establishment of ponderosa pine reproduction. Successful burning of several hundred acres of slash in late September 1943, encouraged night time burning of 700 acres on the south slope of Omak Lake Ridge later during October. This area had a heavy grass ground cover, without much small advance reproduction. However, there were numerous fine groups of large ponderosa pine poles.

Here the first block of 200 acres was burned at night, just before an anticipated rain. The rain failed to materialize and instead a high wind developed. This, together with our mistake in permitting too many torch men to set fires, caused the fire to become wild and it was feared that severe damage had been caused, particularly to the poles. Daylight disclosed, however, that damage was not nearly as severe as anticipated. Most of the poles survived and now are making excellent growth (Fig. 1). The remaining two blocks were subsequently burned without particular difficulty.

During the summer of 1944 the Biles-Coleman Lumber Company perfected tractor piling of slash and with a Caterpillar D-4 tractor piled between 6 and 7 million board feet of slash on about 1,000 acres on the Omak Lake Ridge. This was burned during a light rain storm in late September. Subsequent to the rain nights were frosty and days sunny, but cool and quiet. Under such ideal conditions spot burning of unpiled slash continued until late October, by which time an additional volume of 33 million board feet had been burned on 5,300 acres.

During subsequent years most of the slash was piled by tractor before burning. Spot burning still continued on rocky areas and steep slopes where tractors could not maneuver. In more recent years, slash on such areas has been hand piled.

In applying prescribed burning techniques in disposal of slash the burning crews as they advanced fired accumulations of dead needles, dry grass, windfalls lacing dense reproduction patches, and dead snags, as well as tractor piles and unpiled slash. This was accomplished during favorable periods following first rain storms of autumn or following melting of snow in springtime. If weather turned drier and hotter following burning, creeping fires usually covered most of the ground surface but seldom caused blowups in reproduction patches because heavy fuel had already been burned. Burning always started on ridge tops from logging spurs, skid trails or bulldozed lines, which were utilized to confine the fire to areas designated, and through firing of successive strips proceeded thence down the slopes. Never were fires intentionally permitted to burn up the slopes.

Besides hazard reduction it was hoped that silvicultural benefit would result, through improved growth following thinning of dense reproduction patches and improved seed bed conditions favoring establishment of ponderosa pine reproduction on heavily grassed areas and on areas being taken over by Douglas-fir. Partial destruction of latter species was also considered desirable. Since fire has been an important ecological factor in the ponderosa pine region it was believed that its application under favorable conditions would not cause excessive soil damage or erosion.

Results and Discussion

Effectiveness of prescribed burning in reducing wildlife acreage burned, damage, and cost of control is indicated by data summarized in Table 1. It will be

TABLE 1.—EFFECT OF PRESCRIBED BURNING ON SUBSEQUENT WILDFIRE CONTROL, COLVILLE INDIAN RESERVATION, WASHINGTON

Year	Area type	Number acres	Number fires	Acres burned	Damage	Cost of control	Average per fire: Acres burned	Damage	Cost control	Average per 10,000 acres protected: No. fires	No. acres burned	Damage	Cost control
					Dollars	*Dollars*		*Dollars*	*Dollars*			*Dollars*	*Dollars*
1945	Untreated	1,028,220	33	1,491	2,862	9,125	45.18	86.73	276.52	.321	14.501	27.83	88.75
	Treated	13,780	0	0	0	0	0	0	0	0	0	0	0
1946	Untreated	1,022,530	17	267	450	5,830	15.71	26.47	342.94	.166	2.611	4.40	57.02
	Treated	19,470	1	2	9	9	2.00	9.00	9.00	.514	1.027	4.62	4.62
1947	Untreated	1,012,790	81	1,923	2,957	20,045	23.74	36.51	247.47	.800	18.987	29.20	197.92
	Treated	29,210	8	23	68	208	2.88	8.50	26.00	2.739	7.874	23.28	71.21
1948	Untreated	1,002,370	8	4	24	234	.50	3.00	29.25	.080	.040	.24	2.33
	Treated	39,630	2	0	0	33	0	0	16.50	.505	0	0	8.33
1949	Untreated	996,030	90	8,725	6,902	38,238	96.94	76.69	424.87	.904	87.598	69.30	383.90
	Treated	45,970	5	62	35	356	12.40	7.00	71.20	1.088	13.487	7.61	77.44
1950	Untreated	985,250	21	71	47	2,228	3.38	2.24	106.10	.213	.721	.48	22.61
	Treated	56,750	1	0	6	0	0	0	6.00	.176	0	0	1.06
1951	Untreated	974,010	31	502	6,238	5,760	16.19	201.23	185.81	.318	5.154	64.04	59.14
	Treated	67,990	5	1	0	93	.20	0	18.60	.735	.147	0	13.68
1952	Untreated	956,510	29	64	7,764	2,855	2.21	267.72	98.45	.303	.669	81.17	29.85
	Treated	85,490	3	0	0	58	0	0	19.33	.351	0	0	6.78
1953	Untreated	945,510	108	1,203	5,947	19,191	11.14	55.06	177.69	1.142	12.723	62.90	202.96
	Treated	96,490	30	111	150	1,851	3.70	5.00	61.70	3.109	11.504	15.55	191.83
1954	Untreated	938,470	14	74	271	1,078	5.29	19.36	77.00	.149	.789	2.89	11.49
	Treated	103,530	2	2	0	133	1.00	0	66.50	.193	.193	0	12.85
1955	Untreated	915,420	50	32	80	3,170	.64	1.60	63.40	.546	.350	.87	34.63
	Treated	126,580	10	1	5	367	.10	.50	36.70	.790	.079	.40	28.99
Totals & Averages													
	Untreated	10,777,110	482	14,352	33,542	107,754	29.78	69.59	223.56	.447	13.321	31.12	99.98
	Treated	684,890	67	202	267	3,114	3.01	3.98	46.48	.978	2.949	3.90	45.47
Percent reduction or increase—Treated compared to Untreated							89.89%	94.28%	79.21%	218.79%	77.86%	87.47%	54.52%

noted that following the fire season of 1945, the first year in which there was available a substantial acreage treated by prescribed burning, the "No. Acres" column is cumulative. For each year there is added number of acres treated during the fall and spring immediately preceding the fire season, with untreated acreage adjusted downward accordingly. Maps showing for each year total areas treated to date were compared with yearly fire occurrence maps. From such comparison and analysis of individual fire reports there are summarized for each fire season, by treated and untreated category, number of fires, number of acres burned, damage in dollars, and cost of control. Non-timbered acreages burned are excluded.

From comparison of data from treated with untreated areas summarized in Table 1 prescribed burning has resulted in the following reductions on an average per fire basis: No. acres burned—89.89 percent; damage—94.28 percent; cost of control—79.21 percent.

On an "Average per 10,000 acres protected" basis over twice as many fires occurred on treated areas in comparison with untreated areas. This difference was not statistically significant. Of the total of 67 fires reported on treated areas 6 were man-caused, while 61 were from lightning strikes, principally on Omak Lake Ridge, Whitmore Mountain, and slopes of Keller Butte. From past experience lightning storms have usually caused a concentration of fires on these particular ridges and mountains. It therefore is apparent that under treated category are included areas where lightning fires are most apt to start. Improved access over logging roads may also be a factor resulting in more man-caused fires. Another factor of significance may be the fact that between 200 and 300 thousand acres of high altitude Douglas-fir—western larch, lodgepole pine, and subalpine types are included under the untreated category. During the past 15 year period ground cover in these types has remained green and damp during most of the fire seasons.

On an "Average per 10,000 acres protected" basis, the number of acres burned has been reduced by 77.86 percent. This reduction was not statistically significant. The treatment reduced damage by 87.47 percent and cost of control by 54.52 percent. These results were statistically significant at the five percent level of fiducial probability.

Treatment of the total 126,580 acres has involved disposal of approximately 700 million board feet of slash at a total estimated cost of $700,000. Cost of slash disposal is properly chargeable to cost of logging and is included as such in Bureau of Indian Affairs stumpage appraisals. It is impossible to segregate the portion of the above total cost that should be charged against the intensified prescribed burning method. Data available from war time operations indicate that its application in conjunction with spot burning of slash resulted in considerable savings in slash disposal cost.

It is impossible to predict what might have happened had no slash disposal or intensive treatment been practiced. The following experience is indicative of what could have happened. On the night of August 15 and 16, 1953, dry lightning storms started 90 fires on the Colville Reservation. One fire in logging slash was extremely difficult to control before it burned over 580 acres. Cost of control was

FIG. 2.—Clump of ponderosa pine reproduction on ash and dirt mound where tractor-piled slash was burned on Omak Lake Ridge in spring of 1946. Most severely burned spots are now stocked with reproduction as depicted in this June 1955 photo.

$6,407 and damage was estimated at $3,805. Because of shortage of man power and urgency of controlling other more dangerous fires, no action was taken until evening of the 16th on two fires burning largely on selectively logged land given intensive prescribed burning and slash disposal during the war. Ground cover consisted of perennial grass, with reproduction patches. These fires were easily controlled at combined cost of $1,527. These two fires accounted for the major portion of the 111 timbered acres burned and $150 damage reported on treated areas for 1953 in Table 1.

Had considerable expanses of slash been available for the August 1953 fires to burn through, my experience leads me to believe that damage and cost of control could conceivably have approached or exceeded the total cost of slash disposal.

During war years when it was considered that the slash situation was threatening, we were always dealing, in burning operations, with slash from one to several years old. Logging spurs and skid trails, though serving as excellent fire lines, also made it necessary in the interior of the various burning blocks to set many fires in order to approximate 100 percent coverage. Prescribed burning in ponderosa pine should be applied one year before logging, preferably during the previous fall. Under favorable conditions, it can be applied by experienced men at a cost of but a few cents per acre. During logging, occasional previously fire scarred trees that have burned down can, of course, be salvaged. As nearly as feasible, in felling green trees, extra care can be exercised to keep felled tops away from reserved trees and pole groups. Following log-skidding, piling-tractors can push slash away from close proximity of any trees that might be damaged by fire. The slash can then be disposed of in whole or in part by spot burning with but minimum effort necessary to prevent fires spreading into adjacent areas. Under such procedure and under conditions similar to Colville conditions effective slash disposal and hazard reduction can be obtained at very reasonable cost.

Though we have no verifying statistics or data for analysis or presentation, in my opinion prescribed burning yields important silvicultural benefits. These are indicated by observation and corroborated by photographic evidence.

Results of thinning dense reproduction are spotty, some patches being thinned too severely and others not enough, as described for the 1942 prescribed burning operation. On the average, however, it may be considered that thinning is conservative. A report on the 1942 operation, soon to be completed by the Pacific Northwest Forest and Range Experiment Station, should be indicative of growth improvement resulting from such thinning.

In discussing possibilities of prescribed burning much ado is sometimes made over "damage to the soil," despite countless centuries of exposure of soils in the ponderosa pine region to periodic burning. In some instances it appears there are anticipated results similar to those attributable to devastating wild fires such as have recently burned in Southern Oregon, in California, and the Southwest. A study by soil chemists of the University of Arizona of effect of burning on certain soils of Northern Arizona seems to indicate that complete destruction of the duff covering the forest floor can be taken as a criterion of damage of soil (*1*). On the Colville, severely burned spots occupy but a small percentage of the total area and are confined principally to spots where slash piles burned and immediately adjacent to windfalls and other pieces of heavy fuel that burned with considerable heat.

There must be compensating benefits for the severely burned spots, particularly at higher elevations, now support vigorous, fast growing clumps of ponderosa pine reproduction (Figs. 2, 5 & 6). This has enabled establishment of ponderosa pine reproduction on heavily grassed areas and on areas formerly dominated by seedlings and saplings of Douglas-fir. Many of the latter were killed by creeping ground fires. Thus prescribed burning has aided greatly in at-

FIG. 3.—Ponderosa pine seedlings are beginning to overtop the heavy pine grass in this July 1947 photo in Twenty Three Mile Valley, where slash was burned in September 1943. Note remnant groups of Douglas-fir reproduction, which would have continued to dominate the understory in absence of fire.

FIG. 4.—June 1955 photo of scene in Figure 3. Note development of ponderosa pine reproduction, which now dominates understory.

taining the result most desired in silvicultural practice, namely perpetuation of the most valuable species.

The grassy broad summit areas of the Omak Lake Ridge, the rolling expanses of Twenty Three Mile Valley and mountains above Hall Creek now support vigorous reproduction stands that are dominated by ponderosa pine (Figs. 3 to 7 inc.). Windfalls, snags and other heavy debris have largely been disposed of and fires are easy to control. These beautiful areas may be compared with slash strewn, windfall laced jungles of Douglas-fir, white fir, or incense cedar reproduction and brush that can now be observed comprising the understory in portions of the untreated ponderosa pine region.

Conclusions

Prescribed burning techniques applied in connection with spot burning and burning of tractor

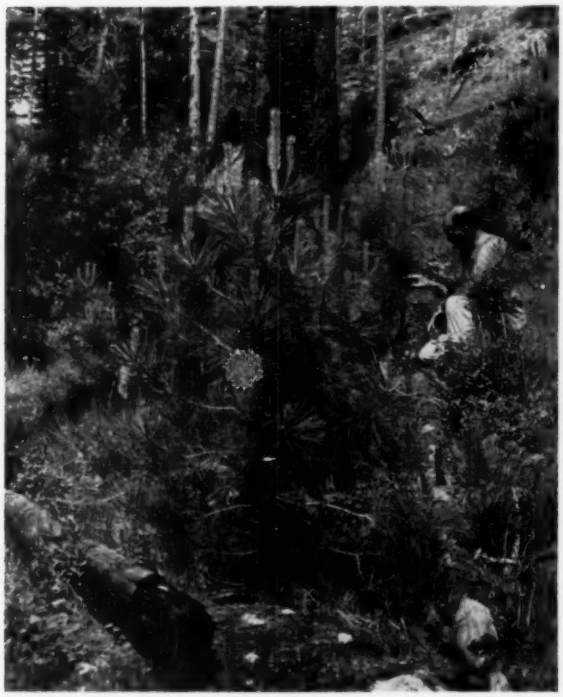

FIG. 5.—July 1947 photo of ponderosa pine seedlings in severely burned spot resulting from slash fire of September 1943 in Twenty Three Mile Valley.

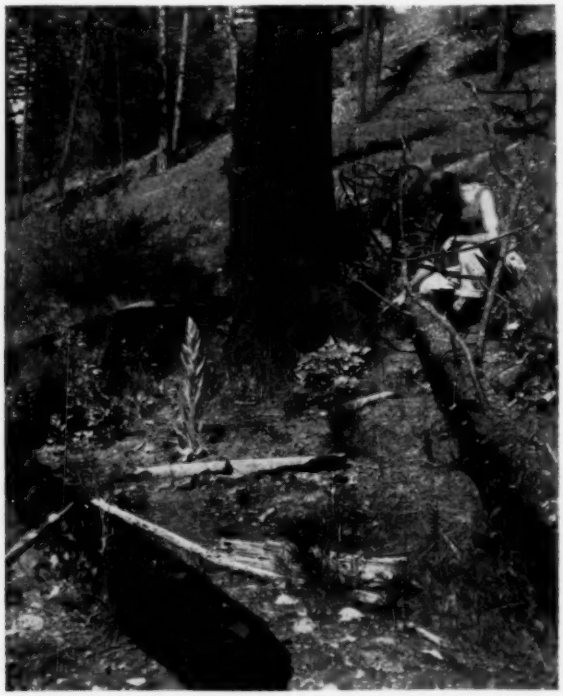

FIG. 6.—June 1955 photo of scene in Figure 5. Note development of ponderosa pine reproduction over past eight years. This is typical of the areas intensively treated by prescribed burning.

FIG. 7.—Excellent ponderosa pine reproduction on north slope near summit of Omak Lake Ridge, where heavy slash was burned in October 1944. Without treatment it is believed Douglas-fir would now predominate. Photo in June 1955.

piled slash on the Colville Indian forest have resulted in a significant reduction in damage and cost of control. It also has resulted in silvicultural benefit. On an average fire basis, in comparison with surrounding untreated areas, number of acres burned has been reduced by 89.89 percent; damage by 94.28 percent, and cost of control by 79.31 percent. On an average per 10,000 acre protected basis, again comparing with untreated areas, there have been over twice as many fires. This is due largely to the fact that areas of highest lightning fire incidence are included. Despite higher fire incidence number of acres burned have been reduced by 77.86 percent; damage by 87.47 percent, and cost of control by 54.52 percent.

Dense reproduction thinning has been spotty, though generally on the conservative side, and has resulted from burning of windfalls and snags that formerly laced these thickets.

Complete removal of duff, which apparently may be taken as the criterion of damage to soil, was confined to a small percentage of total area burned, particularly on spots where slash piles, windfalls, snags or other heavy fuel burned with considerable heat. Vigorous groups of ponderosa pine reproduction now occupy those spots. At higher elevations of considerable expanse more favorable seed bed conditions resulting from the burning have enabled ponderosa pine reproduction to largely supplant that of Douglas-fir, which in continued absence of fire had been capturing the ground.

This is a presentation of a management system—not just prescribed burning. This forest type can be logged and with prescribed burning combined with slash disposal, the fire problems can be greatly reduced. At the same time vigorous ponderosa pine reproduction can be encouraged through control of ground cover and preparation of favorable seed beds.

Results on the areas treated by prescribed burning on the Colville Reservation should be studied by research foresters interested in protection and silviculture for similar treatment should benefit other portions of the ponderosa pine region, particularly areas where ground is being captured by reproduction of inferior associate species instead of by ponderosa pine. To enable application of such treatment a methodology of prescribed burning should be developed, for protection, regeneration, and continued development of ponderosa pine is dependent to a considerable extent on use of fire under proper control.

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The Forest Products Research Society

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HARRIET BEECHER STOWE once wrote, "By what strange law of mind is it, that an idea long overlooked, and trodden under foot as a useless stone, suddenly sparkles out in new light as a discovered diamond?"

To some 3,200 persons in the United States, Canada, and overseas countries, and several thousand additional nonmember readers of its publications, the Forest Products Research Society, professionally speaking, is that new light. Certainly enlightened leaders and organizations comprising the immense forest products industry recognized for many years prior to 1947 the great need for a technical society to serve the manufacturing phase of the wood industry. Also needed was a central clearing house of important fundamental and practical research being accomplished in our various government, educational, and industrial organizations.

In the words of George M. Hunt, past director of the U. S. Forest Products Laboratory, Madison, Wis. and one of the founders of the Society, we needed to provide "a means of bringing together all of the different elements concerned in any way with the production, investigation, distribution, and utilization of the products of the forest." In so doing we would, "in no way be a substitute for professional societies or trade organizations, but a means through which these groups could work together on matters of common interest . . . a horizontal organization cutting across the vertical professional and trade organizations, and bringing together for a common purpose their energies, skills, and interests."

As subsequent events have shown the idea was right; all that was needed was the proper timing. The short but uneasy peace that followed World War II was that time. We had just come though the greatest period of economic and social upheaval that man has ever known, one of vast shortages of essential raw materials coupled with a corresponding upsurge in man's creative and inventive energies. In a relatively few years our forest resources took on new meaning, and the tree became a valuable commodity—to be grown on a perpetual basis as a crop and to be utilized in fuller measure than ever before.

This then was the challenging era as on January 3, 1947 a small group of 14 men representing the three principal branches of industry, education, and government, met in Madison for the purpose of formally establishing an organization that would have as its primary objective, "to encourage and promote the efficient utilization of wood and other forest products in the broadest and most liberal manner." It would do this by:

1. Facilitating the interchange of information and ideas.
2. Sponsoring meetings for the presentation and discussion of reports of investigations and experience of its members and others.
3. Publishing and distributing pertinent information.
4. Promoting standard test methods and procedures.
5. Encouraging acquaintanceships and cooperation among its members.
6. Carrying on related activities that further the objectives of the Society.

This accomplished, the organizing committee then drew up articles of association and by-laws and elected F.P.R.S. first executive board of 10 men, with Fred W. Gottschalk, American Lumber & Treating Corp. Chicago, Ill., as president; and William J. Baker, U. S. Forest Products Laboratory, Madison, Wis., secretary-treasurer. Others on the board included George A. Garratt, dean, Yale School of Forestry, New Haven, Conn.; Bror L. Grondal, University of Washington Forestry Department, Seattle, Wash.; Edward G. Locke, U. S. Forest Service, Portland, Ore.; Jac H. Tigelaar, director of research and tests, Haskelite Manufacturing Corporation, Grand Rapids, Mich.; Robert A. Cockrell, University of California Forestry Department, Berkeley, Calif.; Carl A. Rishell, director of research, National Lumber Manufacturers' Association, Washington, D. C.; Kenneth G. Chesley, director of research, Crossett Lumber Company, Crossett, Ark.; and James F. Hamilton, technical service director, Perkins Glue Company, Lansdale, Penn.

From its original 14 members, the Society has grown until today it numbers well over 3,000. These members come from furniture, lumber, chemical, plywood, veneer, millwork, railroads, logging, pulp, fabrication, and construction industries as well as from education, research, and consulting work. Professionally, they include executives, managers, engineers, sales representatives, technologists, researchers, educators, superintendents, chemists, foresters, consultants, and students.

Membership in the Society is of four types: Supporting, Voting, Associate, and Student. Its approximately 100 Supporting members contribute the substantial sum

[1] *Editor's note.*—This is the fourth in a series of articles dealing with the organization and objectives of technical societies that should be well known to readers of the JOURNAL OF FORESTRY.

of $100 yearly toward the additional finances which the Society requires for its diverse activities. The largest number, some 2,600 are of the Voting or Associate category, and contribute $15 yearly dues. Three hundred are Student members, at $3 per year. Not being strictly a professional society, such as the S.A.F., the sole requirement for membership in F.P.R.S. is an active interest in forest products technology.

The organization of F.P.R.S. is headed by a National Executive Board composed of five executive officers, six regional members, and the executive office staff. In addition, the United States and Canada are divided into six geographic regions within which are located a total of 13 chapters, or Sections. Organizationally, members function for the most part at the Section level; the Section executive leaders in turn submit their suggestions and problems for the attention of the National Board.

The top presiding officer of the F.P.R.S. is its president, Ralph H. Bescher, assistant to the vice president and general manager, Wood Preserving Division, Koppers Company, Pittsburg, Penn. Other officers include president-elect Frank H. Kaufert, director, School of Forestry, University of Minnesota; vice president W. Jeter Eason, vice president, Nickey Brothers, Memphis, Tenn.; and past president Moss B. Christian, director of research, Chicago Mill & Lumber Company, Tallulah, La.

The regions comprise the northeast, southeast, north central, south central, northwest and southwest areas of the North American continent excluding Mexico. The Sections operate with a great deal of independence under their own by-laws which are harmonious with the national constitution.

The thirteen Sections within these regions are: Northeast (the largest) Carolinas-Chesapeake, Florida-Georgia-Alabama, Eastern Canadian, Great Lakes, Ohio Valley, Midwest, Upper Mississippi Valley, Inland Empire, Pacific Northwest, Northern California, Mid-South, and Pacific Southwest (the smallest section). Each Section has a governing body similar to the national organization consisting of a chairman, vice chairman, secretary, treasurer, and a number of trustees. As the Society grows it is anticipated that additional Sections will be established. For example, of late there has been interest shown in the establishment of a Section in the Philippines and possibly of one in Great Britain. Each section varies in its interests, depending on the predominant nature of the wood industry within its geographic area. For example, Society members in the Carolinas-Chesapeake, Great Lakes, and Pacific Southwest Sections are drawn principally from the furniture and allied wood manufacturing industries. Their programs concentrate on these industries. In the Pacific Northwest the concern is primarily with lumber, hardboard, and similar by-products manufacture. The Midwest section stresses millwork, sash and door, machinery, and machining technology. The interests of all the various Sections are brought together in the *Forest Products Journal*, and the Society is able to sustain a fairly representative cross section of major wood technology developments in all branches of the industry.

F.P.R.S.' national executive office is located in Madison, Wis., adjacent to the U. S. Forest Products Laboratory. Here the executive secretary and his staff consisting of editorial, advertising, membership records, and acquisition departments, carry on the in-between-meeting activities of the 3,200 members and subscribers.

Three underlying operations are the foundation stones of the Society and without them it would cease to function. These are its meetings, committees, and publications. In 1955, 17 meetings were held in major wood industry areas from coast to coast, culminating in June 1956 in the 10th National Meeting which drew some 1,000 persons to Asheville, N. C. F.P.R.S. meetings, regardless of size, are similar in that they provide the place for presentation of papers and discussion on subjects relating to the specific interests of the immediate audience. Much of the technical advance in the wood industry is initiated at these meetings.

Behind the organization and meetings of F.P.R.S. are more than 20 committees, 14 of which comprise technical Divisions, and the balance, operating. The Divisions cover glues, wood preservation, marketing, packaging, veneer and plywood, machining, seasoning, finishing, lumber, logging, particle board, quality control, education, and chemical utilization. Their principal function is to develop the technical program for the national meetings. In addition, they are a medium for interchange of advance technical information between experts, and for coordinating and publishing the principal developments in each field via the *Forest Products Journal*. Each Division is headed by an appointed steering committee representative of the field served. Membership is open to all.

The zeal of the Sections and Divisions is reflected in the Society's efforts in the publications field principally its monthly *Forest Products Journal*, which now has a circulation of approximately 3,500 copies per month. Like the international organization it represents, each issue reflects data of interest to every phase of wood technology throughout the United states and Canada. It also reaches some 44 free countries overseas. In addition to the journal, the Society maintains a back-log of "Annual Proceedings" since 1947 as well as limited copies of its loose-leaf "Wood Technology Series" which contains reprints of Society papers in specific fields such as wood particle board, glues and gluing, wood preservation, sawmilling, etc.

Even for those who have been intimately associated with the F.P.R.S. since its inception it is difficult to appreciate the strides which it has made in a decade. This progress can best be summed, again in the words of George M. Hunt, who said, "then we were

nothing but an idea. Today we are a vigorous organization of over 3,200 members in 31 countries. We have 12 local Sections in the United States and 1 in Canada. We started with $130; our budget last year was $80,000. Size of budget and number of members, however, do not necessarily indicate the value or usefulness of an organization. The usefulness of an organization is measured by what it accomplishes. The Forest Products Research Society, after ten years of activity, can confidently stand up to be measured by that yardstick.

"We have provided a means of publishing the thoughts and the findings of all who are concerned with forest products, whether the material to be published relates to chemistry, engineering, electronics, education, business management, or any other subject. The only requirements are that the material shall relate to some phase of the Society's field of interest, shall be well written, and shall be useful. We have already, through our publications, provided a storehouse of useful information that has reached the shelves of libraries throughout the world and is being studied and cited with increasing frequency.

"We have aroused the interest of many companies and individuals and stimulated them to work more actively and aggressively for the advancement of our common interests. We have brought research and industry closer together in our field and this contact has given to each a greater respect and consideration for the other.

"We have provided local sections so that members in different parts of the United States and Canada can get together at frequent intervals for discussion of problems of regional or local interest."

Section Box Score 1957 Membership

Section	Applications received[1] Feb. 1957	Total 1956	Total 1957
Allegheny	12	58	31
Appalachian	0	58	4
Central Rocky Mountain	2	32	8
Central States	0	42	2
Columbia River	6	77	12
Gulf States	11	79	12
Inland Empire	1	32	2
Intermountain	2	35	2
Kentucky-Tennessee	3	12	3
New England	7	61	19
New York	14	45	17
Northern California	0	67	6
Northern Rocky Mountain	3	31	30
Ozark	3	19	39
Puget Sound	4	44	12
Southeastern	14	92	71
Southern California	0	2	1
Southwestern	0	2	0
Upper-Mississippi Valley	16	72	22
Washington	2	1	3
Wisconsin-Michigan	2	102	11
Totals	102	963	307

[1]Students, Junior, Affiliate, Associate (Initial) grades only.

School Box Score 1957 Membership

School	Student applications received Feb. 1957	Total 1956	Total 1957
Alabama Polytechnic Institute	0	6	19
University of California	0	53	6
Colorado A & M College	0	28	4
Duke University	0	7	2
University of Florida	0	25	3
University of Georgia	9	30	41
University of Idaho	1	21	2
Iowa State College	1	31	4
Louisiana Polytechnic Institute	0	27	0
Louisiana State University	9	22	9
University of Maine	3	13	10
University of Massachusetts	0	20	0
Michigan State University	0	50	5
University of Michigan	0	24	3
University of Minnesota	13	26	16
University of Missouri	0	2	35
Montana State University	3	17	30
State University of New York	13	38	15
North Carolina State College	0	24	1
Oregon State College	5	44	8
Pennsylvania State University	4	35	10
Purdue University	0	36	1
Utah State Agricultural College	2	28	2
University of Washington	2	21	9
West Virginia University	3	5	16
Yale University	0	13	4
Total	68	646	255

Notes

An Improved Method for Estimating Quality in Standing Trees

The grades of individual logs in standing trees generally are expressed in terms of 16-foot logs to coincide with standard volume tables. Loggers are not bound by this restriction, however, and can (or should) buck each tree into varying log lengths so as to increase grade recovery and to meet their market requirements. In an attempt to narrow the difference between cruise quality estimates and the actual recovery possible when bucking for maximum log grade, the Forest Service has suggested grading 16-foot logs in standing trees on the basis of the best 12-or-14-foot section of the log. "When any 12-foot or 14-foot section of a 16-foot log is better than the entire log, the grade of this section shall be given to the entire log. Top logs 12 feet and over . . . shall be graded on the basis of actual length" (*1*).

This principle was tested recently on 203 black oak (*Quercus velutina* Lam.) trees cut on 10 commercial logging operations in southern Illinois. Diagrams showing surface defects were made of each log actually cut, plus all unutilized merchantable sawlog material in the tree from which the log or logs were cut. In the office, each tree was "re-assembled" by placing its component log diagrams end-to-end.

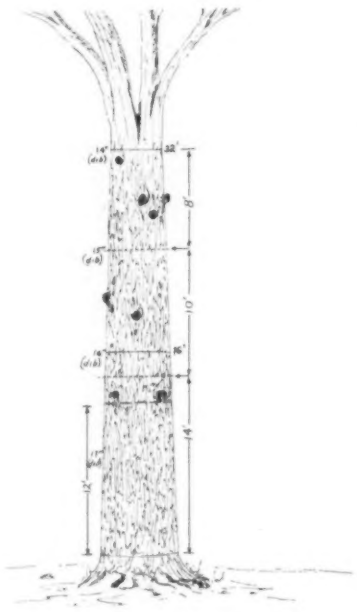

FIG. 1.—Sample of diagrams which were prepared in this study showing surface defect for each log actually cut.

The trees were then graded in three ways using the hardwood factory log grades developed at the U. S. Forest Products Laboratory (*2*). Merchantable logs not qualifying for any of the three factory grades were classified as local use logs (*1*). First, 16-foot log sections were marked off and graded. Then the 16-foot sections, representing the logs which would have been graded in the standing tree, were assigned a second grade based on examination of the best 12-or-14-foot section in each log. Finally, maximum log quality recovery was determined by "bucking" the reassembled tree for the highest total value of the tree (*4*). Sweep, crook, and location of surface grading defects were considered in determining the location of the bucking cuts for maximum grade recovery. End defects were not considered in determining grade by any of these methods since they would not have been visible in the standing tree.

Three quality indexes were computed for each tree—one for each of the three grading methods—by weighting the individual log quality indexes according to their volumes[1] (*3*). The mean tree quality indexes for the "best 12-or-14-foot" method were compared, as paired observations, with the mean tree quality indexes for the 16-foot grading method, and for optimum bucking. Correlation coefficients and mean differences were computed for each of the comparisons.

As might be expected, basing the grade of each 16-foot section on the grade of its best 12 or 14 feet resulted in mean tree quality indexes significantly higher than those obtained by grading the full 16 feet. However, the mean tree quality indexes obtained by optimum bucking and by the "best 12-or-14-foot" method were nearly identical. The correlation coefficient between mean tree quality indexes by "best 12-or-14-foot" grading and by optimum bucking was remarkably high, 0.87. A "t" test of mean differences between the two systems was not significant.

As an illustration of how this

TABLE 1.—COMPARISON OF QUALITY INDEXES ON A SAMPLE TREE BY THREE DIFFERENT GRADING METHODS
(International ¼-inch rule)

Log number	Grading length	Volume	Grade	Quality index
	Feet	*Bd.-ft.*		
GRADING BY 16-FOOT LOGS				
1	16	180	2	0.66
2	16	135	3	.55
Total	32	315	—	—
Mean tree quality index				0.61
GRADING BY BEST 12 FEET OF ALL 16-FOOT LOGS EXCEPT TOP LOG				
1	12	180	1	0.96
2	16	135	3	.55
Total	28	315	—	—
Mean tree quality index				0.78
GRADING BY OPTIMUM BUCKING				
1	14	155	1	0.96
2	10	95	2	.64
3	8	65	3	.65
Total	32	315	—	—
Mean tree quality index				0.78

[1] An expression of relative log value in terms of the price of 4/4, No. 1 Common air-dried lumber.

principle might work in actual practice, the value of the sample tree shown in Table 1 would be grossly underestimated when graded by 16-foot logs, but correctly predicted by "best 12-or-14-foot" grading.

Conclusions

On the basis of these tests, the actual log quality recovery possible from a stand can be best estimated by basing the grade of each 16-foot log tallied in the standing tree (except top logs) on its best 12 or 14 feet of length. Although this study was conducted on black oak in southern Illinois, the principle tested should apply to other species in other hardwood areas.

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The Key To Effective Basal Spraying of Woody Plants: Wet The Root Collar

Basal spraying with an oil solution of 2,4,5-T, or a mixture of 2,4,5-T and 2,4,-D, has become a standard method for killing the miscellaneous types of woody growth commonly referred to as "brush." Properly done, this method will result in root kill of nearly all hardwood species and is effective at all seasons of year.[1]

Yet anyone with experience in basal spraying for brush control is well aware that 100-percent kills are rarely achieved. With the more resistant species, a disconcertingly large proportion of the plants may resprout from the root collar or stem bases. Why should some plants or sprout clumps die, while others of the same species, treated apparently in the same way, resprout and recover?

In 1953, Bramble, Worley, and Brynes[2] reported an experiment that goes far toward answering the above question. This experiment was so elegantly simple in concept, and the results so clean-cut and conclusive, that it deserves recognition as a classic in brush-control research. Later the same year, the writer put in a partial repetition of Bramble's experiment, with variations, to see whether or not his sharply defined results would be confirmed. Since foresters are becoming increasingly involved in one way or another in chemical brush control, and since Bramble's experiment was reported in a medium that does not circulate widely among foresters, the purpose of this note is further to publicize the results of his work, and to report our confirmation of those results.

Bramble's Experiment

Working with scrub oak (*Quercus ilicifolia*), a fairly difficult species to kill, Bramble and his associates tested various placements of 2, 4, 5-T solution on the lower stem and root-collar portions of the plants. To facilitate controlled placement in certain treatments on the root-collar zone, they scraped away the litter and upper inch or so of soil around the individual root crowns.

They found that suppression of basal resprouting and apparent death of roots depended upon complete wetting of the root-collar zone. Wetting the stem bases without wetting the root collar killed the stems above the zone of application, but was followed by prolific sprouting from previously dormant buds around the root collar—just as often happens after a routine job of spraying. But when the root collar was thoroughly wetted, the dormant buds were killed, hence no resprouting, and the plant died. With treatment of the root collar, wetting the basal foot or so of the stems, as is generally recommended, proved to be superflous; the stems died as usual above the zone of application, regardless of the height to which the application was extended.

There it was, definite and unequivocal: wet the stem base and root-collar zone of the dormant buds completely, and all plants die; leave all or part of this zone untreated and the plants resprout, regardless of stem treatments above. Though the samples in the experiment were only 10 sprout clumps per treatment, the all-or-nothing character of the results was highly convincing.

These findings clearly point to incomplete wetting of the root collar as the explanation for the resprouting that occurs after most routine spray jobs. The practical application is that, by recognizing the root collar as the critical area to be reached with the herbicide spraymen can direct their nozzles and estimate the requisite volumes more effectively. An appreciable improvement in spraying efficiency would seem to be a reasonable expectation.

Bramble and co-workers recognized that the necesary wetting of the root collar probably would require more silvicide solution than

[1] With root-suckering species such as aspen and sassafras, better kills may be obtained by midsummer applications, and even then one or more follow-up treatments may be required for a complete kill.

[2] Bramble, W. C., D. P. Worley and W. R. Brynes. Effect of placement of dormant basal spray on top killing and sprouting of scrub oak. Northeast. Weed Control Conf. Proc. 7:309-311. 1953.

is required in the usual procedure. They suggested in their 1953 paper (and in 1955[3] presented some supporting evidence) that, with larger volumes, lower concentrations could be used and still achieve better than usual kills at little or no increase in cost.

Results Corroborated

Our test—in part repeating Bramble's work—was made on the Delaware-Lehigh Experimental Forest in northeastern Pennsylvania in mid-July 1953. Our treatments were as follows:

1. 15 scrub oak clumps with root crowns exposed by scraping away litter and the upper 1 to 2 inches of soil; top and sides of root crowns thoroughly wetted with spray; stem bases wetted only as incidental to above;

2. 15 similar clumps treated without exposing crowns, but with conscious effort to get run-down over and around the crown to all areas possibly having dormant buds; stem bases wetted only as incidental to above;

3. 15 similar clumps treated without exposing crowns, according to the usual instructions, spraying the basal 12 to 18 inches of all stems to the point of free run-down.

All treatments were with 2,4,5-T ester at 8 pounds acid equivalent per hundred gallons of diesel oil (12 to 20 pounds have been widely recommended in the past for basal spraying). Since the sprout clumps varied in number of stems and size of root crown, no attempt was made to measure quantities of solution per clump. Each was given what we considered thorough coverage. In treatment 3 (the routine procedure), we tried to do an honest job of wetting with run-down as a field crew following the usual instructions might do; this of course was not so thorough a soaking of the crown as in treatment 2.

Final observations were made 2 years later. Kills were as follows:

Treatment 1 (crowns exposed): 15 plants all dead.

Treatment 2 (directed treatment): 14 plants dead, 1 plant recovering weakly.

Treatment 3 (routine application): 1 plant dead, 1 plant possibly dying, 13 plants recovering.

These results are in full agreement with those reported by Bramble and associates—that the crucial area to reach with the herbicide is the root collar and its dormant buds. Simply wetting the stems until there is free run-down, as in treatment 3, does not completely accomplish this, and many plants recover.

In our experiment and in the work reported by Bramble's group in 1955, a further step was taken toward adapting this knowledge to practical field procedures. Our treatment 2, with 14 clumps killed out of 15 treated, demonstrated that a solution of 2,4,5-T, used with conscious effort to reach the root-collar buds, can yield a high percent of kills.

Bramble's group accomplished apparent root kills of 80 to 85 percent by sprays definitely aimed at the root-collar zone. With large, multi-stemmed sprout clumps such as are typical of much hardwood brush, and with the basal portions covered by litter, one must expect occasionally to miss a sector of the root-collar zone, and so fall somewhat short of 100-percent kills. The above tests show, however, that the partial misses and resultant recoveries can be held to a reasonably small percentage.

Proper Application

Inasmuch as all of these tests have the weakness of dealing with only one species—scrub oak—an unqualified assertion that similar results would be obtained with all species cannot be made. However, it is reasonable to expect that all hardwoods, except those that root-sucker, will behave in much the same way.

Proper application *often* is emphasized as the key to successful brush control. Obviously, then, it is essential to understand precisely what is proper application—what are the important steps or aspects of the job. Although instructions and discussions pertaining to basal spraying almost universally specify free run-down of the solution from the stems, they go no further. They do not attempt to explain how much run-down is enough, why it is important, or what precisely is the objective.

To promote better understanding, and thereby to get better application, it would be helpful if formulators of herbicides and others who offer instructions on basal spraying would point out the necessity of killing all the dormant root-collar buds at and below ground line if resprouting and recovery are to be prevented, would explain that these dormant buds can be killed on resistant species only by complete and thorough wetting of the root-collar zone, and would explain that the objective of the run-down is to accomplish such wetting.

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[3]Worley, D. P., W. C. Bramble, and W. R. Brynes. The effect of volume, concentration, and point of application of 2,4,5-T in the basal treatment of bear oak. Northeast. Weed Control Conf. Proc. 9: 439-444. 1955.

FAO Panel On Education Organized

Following a resolution of the Third World Forestry Congress, the Director General of FAO has appointed a special Panel on Education in Forestry. The current membership is:

France—A. Metro
Germany—J. N. Koestler
Italy—G. Giordano
Netherlands—G. Houtzagers
Sweden—K. T. Streyffert
United Kingdom—I. O. Robertson
Canada—(to be nominated)
United States—H. L. Shirley
Mexico—F. Castro Flores
Argentina—Nicolas Constantino
Chile—Hernan Rosales
Venezuela—J.-P. Veillon
Union of South Africa—(to be nominated)
India—K. L. Aggarwal
Japan—Chuhei Hara

Syria—(to be nominated)
Australia—M. R. Jacobs
FAO—T. Francois & G. G. Watterson

Each of the above members has been assigned certain other countries so that every member nation of FAO is covered.

The panel held its organizing meeting at Oxford, England, on July 13, 1956. Aggarwal, Koestler, Shirley, and Watterson were the only members present but Great Britain and France sent deputized members and nine other countries sent observers. The Director General made it known that he had appointed H. L. Shirley chairman of the panel and G. G. Watterson secretary. The meeting then proceeded to adopt a general statement covering purpose, scope, and organization of the panel. The purpose is stated as follows: "The FAO Panel on Education in Forestry is established to advise FAO on all phases of education in forestry. It also is to promote liaison among forestry schools of the world and between the schools and FAO. It will prepare agenda for discussions of education in forestry for international forestry meetings and prepare reports on such discussions. It will conduct such special studies on forestry education as FAO may require or the Panel members may decide upon and report the results thereof. It will serve to facilitate student and faculty exchange programs and to provide information on study opportunities at various schools. It will advise FAO on personnel for staffing technical missions and within its sphere of competence perform such other expert services in education in forestry as FAO may require."

The panel's main attention is to be devoted to university-level forestry education leading to an academic degree and representing full professional qualification of the graduate. It will, however, give some attention to sub-professional education. The panel is an agency of FAO and will work mainly through existing national and international agencies dealing with education in forestry. The officers consist of a chairman, secretary, and a continuing committee. Working committees, as needed, may be appointed, membership of which need not be restricted to panel members. Annual reports by the chairman to the Director General of FAO are required. These are to be briefed in UNASYLVA.

Foresters interested in having more information on this panel may consult the heads of individual forestry schools in the United States and look for further information in an early issue of UNASYLVA.

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Indications of Linear Dependence of D.O.B. Increases on D.I.B. Increases in Loblolly Pine at 17.3 Feet

McCormack,[1] recently computed an exceptionally close linear dependence of d.b.h. increases in loblolly pine on d.i.b. increases at breast height. Based on a sample of 2,654 loblolly pine drawn largely from Virginia, South Carolina, Georgia, and Florida, he reported d.b.h. to increase at an average rate of 1.095 inches for each inch of increase in d.i.b. at 4.5 feet from the ground.

Data for Girard's form class on loblolly pine were collected near Auburn, Alabama, during 1954. Since then, additional data have been received from contributors[2] near Dadeville, Tuscaloosa, and Fayette, Alabama. The complete sample consisted of 237 loblolly pine trees ranging in total age from 30 to 85 years. Diameters outside bark at 17.3 feet were measured to nearest .05 inch by a diameter tape. Single bark thicknesses at 17.3 feet were computed by averaging three individual Swedish bark gauge measurements on each tree. These bark determinations were made to the nearest .05 inch at 120° intervals around the circumference of each tree. Diameters inside bark at 17.3 feet were grouped into one inch classes. These classes ranged from 7.0 inches through 14.0 inches.

Plotting d.o.b. at 17.3 feet by one inch d.i.b. classes indicated a linear relationship. Computation of the line of best fit yielded the formula $\hat{Y} = 0.153 + 1.077X$. The percent of correlation (r^2) for this relationship computed at 99.6. Thus the average rate of d.o.b. increase at 17.3 feet in loblolly pine, based on this 237 tree sample, is indicated to be 1.077 inches for each increase of one inch in d.i.b. at that point.

It seems interesting to note the similarity in line slopes indicated for d.o.b. increases at 4.5 feet and at 17.3 feet from these two widely divergent sampling locations.

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[1]McCormack, James F. An allowance for bark increment in computing tree diameter growth for southeastern species. Southeastern Forest Expt. Sta. Paper No. 60, Asheville, N. C. 1955.

[2]Contributors of data were the Alabama Power Co., the Gulf States Paper Corp. and the Agric. Expt. Sta. of the Alabama Polytechnic Institute.

Growth of Planted Slash Pine Air-Layers

One year after planting in a nursery, slash pine air-layers[1] from 6-year-old saplings showed a strikingly better growth response and root development than air-layers from 23-year-old trees. Several trees of each age class were used for the test, and the growth rate of the air-layers was consistent within each class. The air-layers, or marcottes, were part of an experiment which tested some factors affecting root formation by this method of vegetative propagation.

For the planted branches, identical air-layering techniques were used at the same time and for the same rooting period on both the younger and the older trees. Twenty-five air-layers with good root systems were selected for outplanting. Fifteen marcottes from the saplings and 10 from the older stock were planted during the second week of October, 1954. From the start, the branches from the younger trees were almost three times as tall as those from the older stock and had better developed root systems. The plants were mulched and fertilized at planting time and were watered regularly on nursery schedule.

One year after planting, the marcottes from the 6-year-old stock had grown 3½ times as much as those from the older trees (Table 1, Fig. 1). Of the 25 air-layers planted, only one (from the younger stock) had died.

TABLE 1.—ONE YEAR'S GROWTH OF PLANTED SLASH PINE AIR-LAYERS

Stock	Planted height	Height after 1 yr.	Growth
		Feet	
6 years old	1.80	4.79	2.98
23 years old	0.66	1.51	0.85

After growth was measured, the marcottes were lifted to inspect their root development (Fig. 2). All plants exhibited an extensive and well-distributed lateral root system; more than half also had sinker-type roots which penetrated to a depth of several feet. In general, roots on the air-layers from younger stock were longer and more numerous than those on air-layers from the older trees.

Unfortunately, the marcottes all had to be removed from the nursery since they were planted to test survival rather than to compare growth. It is quite possible that the growth differences reported here will disappear in time. Also, there may be an age beyond which the effect of age class on the growth rate of marcottes is negligible and tree-to-tree variations in vigor become more apparent. These differences between individuals form the basis for selection and progeny testing, and are an important reason for vegetative propagation. To test these possibilities, a new study involving slash pine trees from 5 to 40 years of age has been initiated to observe the growth pattern of marcottes for a much longer period.

P. E. HOEKSTRA AND
R. W. JOHANSEN
Southeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture

[1]Air-layering is a method of vegetative propagation whereby roots are induced to develop on branches while they are attached to the tree.

FIG. 1.—Slash pine air-layers, 1 year after planting in the nursery. The short plants at the left are propagated from 23-year-old trees; the tall plants at the right are from 6-year-old saplings.

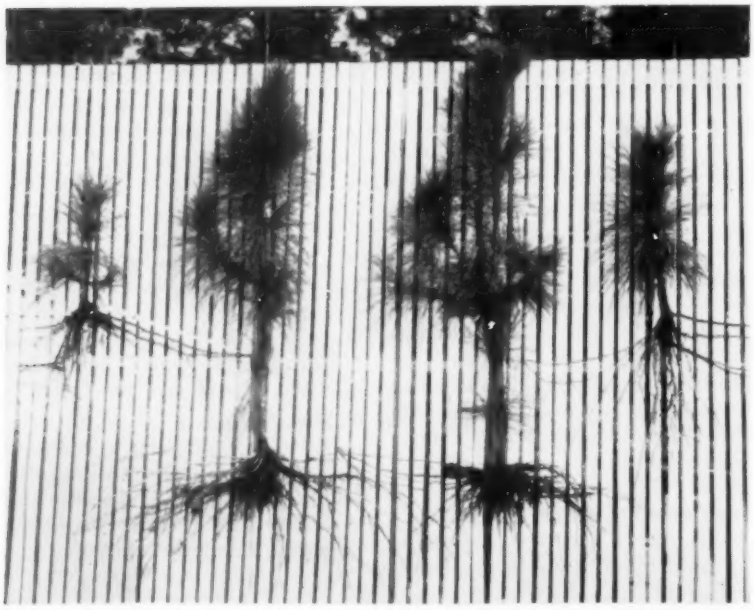

FIG. 2.—Lifted slash pine air-layers showing differences in height and root system. The two smaller, outside plants are propagated from older stock; the two larger plants in the middle are from younger stock.

Reviews

Experimental Design

By Walter T. Federer. 544 pp. Macmillan Company, New York. 1955. $11.

Developed out of teaching experience, this text is aimed to give "A comprehensive coverage of the design and the analysis of experiments . . ." The general plan is to present the basic pattern for a particular design early in a chapter along with some discussion of advantages and disadvantages. This is followed by variations in the design and components analysis.

Subject material includes chapters on the completely randomized design, randomized blocks, latin squares, factorial designs (4 chapters), incomplete block designs, lattice designs, balanced designs, and covariance analysis for a number of designs presented. The selection of illustrative material is largely agricultural. The book is mainly concerned with procedural detail based on an assemblage and digest of literature. The bibliography is extensive with 340 entries which are liberally cited in the text.

Considerable knowledge of statistics is assumed; the author states that the reader "will need to understand basic statistical analyses and concepts as described in the texts by . . . Snedecor . . . and Fisher." If he does not have a good grasp of general statistical literature besides, the reader will get little out of this book. The author relies heavily on literature and strongly tends to talk about authors, designs, and analyses rather than to develop directly and systematically his material. The author has written this book for the reader who will be closely familiar with or will look up supporting literature. A great deal of detailed mathematical development is given, but it is hard to follow without considerable background.

Treatment of the principles and philosophies of experimental design and their application in experimentation is scanty. The author enumerates some advantages and disadvantages of particular designs in a number of chapters but gives them limited development. Major concern is with analysis forms rather than with interpretation. The book seems to be written for a statistician with emphasis on analysis breakdowns and procedures for the more complex designs. It is not aimed for an experimenter of limited background desirous of gaining an insight into wise selection of design.

The writing is difficult and not helped by the mixture of regular and fine print and the rather awkward and arbitrary notation system employed to identify tables and captions. For example, V-1.6.2. on page 126 marks the second item under the sixth subheading of the first major subject-matter division of Chapter 5. Transitions are often abrupt and explanations seem cryptic unless one is already rather fully informed on the subject. The treatment is strongly mathematical with many pages largely consisting of formulas and formula development.

The book should be a part of and a valuable addition to a selective library on experimental design. It contains a wealth of procedural and illustrative material and gives a key to a large amount of literature on the subject. It should be recognized that no treatment of experimental design can be expected also to include development of its statistical foundation.

KENNETH P. DAVIS
University of Michigan

Forest Practices Developments in the United States 1940 to 1955

Report of the Committee on Forest Practices, Division of Silviculture, Society of American Foresters, Washington, D. C. 33 pp. 1956. $1.

The value of this bulletin is best exemplified by a statement contained in the introduction, "The Committee on Forest Practices of the Society of American Foresters felt that an assemblage of information documenting the development of forest practices during this period would be a useful and lasting contribution to the profession." This statement is very true.

Again quoting from the introduction, "The report is in three parts. The first is a short statement highlighting major developments during the period affecting forest practices and appraising some lessons learned. The second part gives a digest and summary of present state legislation on cutting practices, nearly all of which originated during the 1940 to 1950 decade. The third part consists of an annotated bibliography giving a key to much of the pertinent written material originating during the period. While major emphasis is on happenings during the 1940's, the state legislation digest and the bibliography have been carried through 1955 as nearly as the Committee was able to do so."

This bulletin succinctly and completely reviews the highlights and thinking involved in the development of forestry for the period named. It also forecasts to some extent what can be expected in the future.

Naturally and logically it does not delve into the intricacies of forest practices as they might be applied in various localities.

It contains all the basic information on state laws regulating cutting practices along with a complete bibliography on forest practices by states.

In making this information available in one concise bulletin the Committee, under the chairmanship of Kenneth P. Davis, has made a very substantial contribution. As a source of information it should be a part of every forester's library.

GEORGE R. MOORHEAD
New Jersey Department of Conservation and Economic Development

Conserving American Resources

By Ruben L. Parson. 550 pp. Illus. Prentice-Hall, Inc., New Jersey. 1956. $8.65.

Not a book that the technical worker in any particular field, with the possible exception of the geographer or conservationist, can use in his work, it is, however, one that the forester might want to read critically to refresh his perspective on the place of forestry in resource management.

The purpose of this book is to propagandize, to generate the layman's interest in conservation—" . . . the fullest possible use of them [our natural resources] without abusing the ones exploited, without destroying any needlessly, and without neglecting any that can be used."

The author is professor and chairman of the Department of Geography at East Tennessee State College.

Five chapters open the book. The first two deal with an introduction and basic concepts; the next two with water and soils, the "basic" resources; and the fifth with land management.

In Chapters 6 through 14 the author treats the misuse and the conservation of the resources associated with the land—its water, the soil, the forest, the grasslands, wildlife, and, finally, the resources that contribute to the exaltation of the spirit.

The final three chapters deal with the resources of the seas, the conservation of minerals, and proposals and prospects for the future.

Following the body of the work are a 24-page section on teaching aids, a 32-page selected bibliography (in addition to references cited after most chapters), and an index.

The format is most attractive. Many photographs, maps, charts, and drawings effectively complement the text. There are a few maps whose symbols have been blurred in the printing, making them practically illegible.

This reviewer would question some of the statements and concepts in the chapters dealing with forestry. Why associate a term such as *selective cutting* with the "ultimate in good forestry" when selective cutting can be applied to everything from maturity selection to high grading? Has the acreage of eligible land classified under special forest tax laws been great enough to justify the statement that "Tax exemption for land under forest reproduction and deferment of tax on standing timber until it is cut have gotten good response"? Is it true that "Natural reproduction is by far the cheapest and surest means of reforestation"? And what forester would speak of leaving "culls" for seed trees without making perfectly clear the exceptional reasons for following a practice so full of dysgenic potential?

Taken as a whole this book does a good job of emphasizing in simple and readable fashion that there are interrelationships among our natural resources and that it is necessary for man to take these interrelationships into consideration when manipulating the resources for his own ends. The author does much to present a balanced treatment of concepts often subject to considerable misinterpretation. He argues convincingly, for example, that "The miner cannot conserve minerals, the farmer cannot conserve soils, the lumberman cannot conserve forests if he must do it at a loss, year after year."

However, errors of the type pointed out as occurring in the the chapters concerned with the forest resource raise a disturbing question: is it possible for one man to produce a popular work such as this without creating misconceptions as damaging as those corrected? This question is especially important if the book is to be used, as the author suggests, by the layman and also as a text for indoctrinating elementary and high school teachers, none of whom, ordinarily, would have the necessary technical background for criticizing the book. In spite of the book's many laudable features, this reviewer would hesitate to recommend its use by the layman except in the classroom with competent, critical instruction provided.

E. T. SULLIVAN
University of Minnesota

Dendroclimatic Changes in Semiarid America

By Edmund Schulman. 142 pp. Illus. University of Arizona Press, Tucson, Ariz. 1956. $3.

This book is a progress report on the relation between tree growth and precipitation in Western America. The longest significant chronologies from the annual growth rings of the oldest trees are related to rainfall and riverflow. The book is the outgrowth of a conclusion by its author, after some years of work on cycle analysis of tree rings and other series, that a fundamental advance in the field of dendroclimatology might well depend on the derivation of more reliable and extensive tree ring data.

The primary contribution of the paper is long chronologies for essentially all drainage basins of the western United States and southwest Canada. During the latest field surveys three bristlecone pine trees were sampled which were determined to be at least 4,000 years old.

Chronologies are presented in charts and graphs, together with descriptions of the species used,

their locations, both in relation to the forest and to semiarid America, difficulties encountered in analysis of data, and the author's conclusions. The author points out that the problem in ring width analysis, which defies fully satisfactory solution, perhaps more completely than any other, is that of "standardizing" the growth rate. There are included in the final results assumptions which bespeak caution in their interpretation.

Five chapters and three appendices divide the book into almost equal parts. The first part introduces the subject then describes the problem of analysis, such as suitable species, interval of ring growth, errors in ring dating, coefficients of mean sensitivity and cross dating, chronology differences, etc. The appendix, with numerous charts and tables, describes sampled sites and chronologies in Western America, dendroclimatology in the Patagonian Andes, and millenia-old pine trees sampled in 1954 and 1955. References to sources of dendroclimatic series supplementary to those presented appear in the bibliography.

About 300,000 rings from selected drought sensitive trees from semiarid America have been used to derive regional indices which the author believes represent a fair approximation of fluctuations in rainfall in the upper basins of all major streams of the western United States. The author, however, urges caution in the interpretation of the longer fluctuations as climatic changes, even though growth-rain coefficients averaging +0.70 and approaching +0.90 when the growth and rainfall curves were smoothed by three year running means were derived.

A brief sampling will give some idea of seemingly significant conclusions. For example, "In southern California the tendency for longterm swings to one side of the growth-mean or the other, which had been typical for some centuries preceeding the mid-1600s gave way to swings of much shorter duration. This tendency is very pronounced in the Colorado River Basin."

Concerning the present climatic fluctuation, it is pointed out "that comparison of growth fluctuations in recent decades with those for the past several centuries suggests that in many areas of the West the interval since 1870 or so has been one of decidedly abnormal climate. The present climatic fluctuation has taken the form of a major drought in recent decades over much of the West. In the Gila river basin it appears highly likely that the drought beginning in 1921 is the most severe since the late 1200's, that the total deficiency during 1905-1920, in southern Arizona, a period that was probably one of the wettest in many centuries."

The author points out that more light on the present climatic fluctuation will probably come when more extensive significant dendroclimatic histories have been developed.

Even though the literature relevant to dendrochronologic research has become large, the present report is of original observations and should be worthwhile to anyone interested in longtime rainfall and runoff trends.

L. R. RICH
Rocky Mountain Forest and Range Experiment Station

Common Exotic Trees of South Florida

By Mary F. Barrett. 414 pp. Illus. University of Florida Press, Gainesville. 1956. $8.50.

Florida, with a climate particularly suited for the growth of many species which cannot be grown elsewhere in the United States, has been richly embellished with a large number of exotic trees. These exotic species have been admirably described by Miss Barrett. Her book covering these species is both readable and interesting, as well as botanically sound. This is to be expected since she is a well-trained and experienced botanist.

Her explanations of the botanical terms necessary for recognizing the various trees of south Florida are clear and understandable and beautifully illustrated. Her keys are workable and easy to use. The descriptions of genera and the various species are handled in a clear and concise manner with interesting comments on uses and nomenclature.

In addition to giving the native range of each species, the author has concisely set forth by a system of abbreviations various locations in south Florida where each species is to be found. This is a book which should be in the hands of anyone who is interested in trees and who plans a trip to south Florida.

REYNOLDS B. SMITH
University of Florida

Wildlife Law Enforcement

By William F. Sigler. 318 pp. Illus. Wm. C. Brown Co., Dubuque, Iowa. 1956. $4.50

It is an accepted fact that wildlife habitat is no better than the protection afforded it. Wildlife law enforcement has not kept pace with other forms of enforcement, due in a large measure to lack of a well organized training program for new men as well as veterans. Sigler's book fills the much needed gap in the training program. Thoroughness of the author's treatment is evidenced by such subjects as state and federal jurisdiction over wildlife, types of violations of wildlife law, tactics of arrest and preparation of evidence. Procedures of the Federal Bureau of Investigation are widely drawn upon for illustration.

There is a valuable appendix providing definitions of over 380 legal terms which would be of great value to the officer without legal training. Another appendix suggests useful sample legal forms. For the use of the teacher and student there are 71 sample examination questions and a bibliography of 250 publications relating to the subject.

Except for separate chapters in the several wildlife management

texts, this is the first book dealing completely with wildlife law enforcement. It should be required reading for all students expecting to enter the wildlife field. It is also a valuable reference for veteran wildlife law enforcement officers.

It would be well for the sporting public to read carefully the portion of the text dealing with the need for adequate wildlife laws. An informed public would greatly assist in reduction of nonwilful violations. The reader cannot help but become vitally aware of the need for employment of a high type wildlife law enforcement officer corps.

HOWARD A. MILLER
U. S. Fish and Wildlife Service

The Horseshoe Properties Forest Management Demonstration

Tennessee Department of Conservation, Forestry Division. 15 pp. Illus. TVA, Division of Forestry Relations, Norris, Tenn. 1956.

This report is an encouraging sequel to an earlier report, "A Preliminary Management Plan for the Horseshoe Properties Forest Management Demonstration in Marion, Hamilton, and Sequatchie Counties, Tennessee." Both reports are published jointly by the Division of Forestry of the Tennessee Department of Conservation and the Division of Forestry Relations of the Tennessee Valley Authority.

This is one of several case demonstrations where a start has been made on the long road toward converting a depleted forest property to a profitable and productive timber growing enterprise. The public agencies have sparked an idea and provided some guide-lines. The owner, Mr. Z. Cartter Patten, has, in return, agreed to open his books to the public and to make his experience available to others who may have a similar problem to the one he faced ten years ago. In 1945, he agreed to follow the management plan prepared for him and has done so. This in itself is gratifying.

Another important facet of the approach used in this case is that the public agencies have led the landowner to make his own decisions independently. The second cruise and management plan—in 1955—was done by a consultant hired by the landowner.

The report is largely a historical account of the 20,000 acre forest property near Chattanooga, Tenn. It describes significant elements in the management and administration of a typical southern pine-hardwood stand.

Of special interest are significant changes in stocking which have occurred between 1945 and 1955. Volume per acre was 1,492 board feet in 1945; 2,584 board feet in 1955. Basal area in 1945 was 36 square feet; in 1955, 44 square feet. These increases were accomplished primarily through reserving the growing stock and the growth; limiting timber cutting mainly to removal of low-grade hardwoods.

In 1945, predicted annual growth was 113 board feet per acre. Adjusted actual annual growth, as determined by the 1955 inventory, was 109 board feet per acre. In 1955, predicted growth was 195 board feet per acre annually—a figure directly related to the increased board foot stocking. In terms of basal area, the stand is still less than half stocked, so growth is still far below potential for the site.

An interesting financial aspect of the development of this forest is that a non-renewable resource, coal, is being liquidated to finance the development of the renewable timber resource. During the first ten-year period of management, a negligible cash income resulted from combination of profitable coal mining and unprofitable timber management. The outlook for the next ten years is considerably better, but net revenue will be only about 40 cents per acre annually. There has been and will be, of course, a considerable increase in the capital value of the property, but it is worth noting that a badly depleted forest cannot be made profitable over night. And it is a relief to read about a forestry demonstration that is not a "bonanza" to the owner. Significant returns from the timber alone are not expected until persistent, progressive management has been continued for a period of about twenty years.

"Ten Years of Progress" on the Horseshoe Properties is an attractive, well-illustrated, 15 page report. It should be of particular interest and value to owners of depleted forest properties who wish to bring their properties back to productivity, and to foresters who are primarily concerned with educational efforts directed toward such owners.

W. MORRIS MORGAN
Bowaters Southern Paper Corp.

Publications of Interest

The 1956 edition of *Forestry Seed Directory*, published by FAO, can now be secured for $2 from Columbia University Press, International Documents Service, 2960 Broadway, New York 27, N. Y.

In a simple, easy to use form the *Directory* presents a listing of species for which seeds are available and the countries and dealers which can supply the seeds. Many dealers listed have indicated that they are willing to supply certificates showing the quality and origin of seed. A separate section is devoted to Eucalyptus species, places from which seed can be obtained, and the proper climatic conditions for growing.

This directory is published periodically, with each participating government supplying additional information as it is available.

* * *

A new report, *Federal Timber Sales Policies*, of the Public Works and Resources Subcommittee of the House Committee on Government Operations has been issued to give background information on recommendations made in H. Report 2960, 84th Congress. The earlier report dealt with a series of recommendations made for improving federal timber sales policies.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University College of Forestry at Syracuse University*
Range Management Section Compiled by Division of Bibliography, Library, U. S. Department of Agriculture

General

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The Rain Forests of Golfo Dulce. By P. H. Allen. Illus. Univ. of Florida Press, Gainesville. 1956. $8.50.

See Through the Forest. By M. E. Selsam. 45 pp. Illus. Harper, New York. 1956. $2.50. Juvenile.

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Randolph G. Pack (1890-1956)

The death of Randolph G. Pack on Christmas morning marks the end of a life devoted to forestry, conservation, and public service.

Born June 8, 1890, he was the third generation of a family unique in the history of American forestry. His grandfather, George Willis Pack, had been a lumberman and civic leader in Michigan during the 1870's and 1880's, and his father, Charles Lathrop Pack, was one of the small group of pioneers who gave generously of time and money to bring a sense of forest consciousness to the American people. Both of Charles Lathrop Pack's sons indentified themselves prominently with the conservation movement, and Randolph Pack, the elder son, carried on this tradition until his death.

In the words of Ovid Butler, "No finer example of family interest and public service, free of any motive of selfish gain, is to be found in the forest history of America."

Randolph Pack attended Williams College and was a special student at the Forestry School of Pennsylvania State College. Later he worked as a logger in Montana, and engaged in lumbering operations in Louisiana. In 1937 he succeeded his father, Charles Lathrop Pack, as president of the Charles Lathrop Pack Forestry foundation, and was for almost 20 years the guiding head of that organization. It alone, among all the privately endowed foundations in America, has as its stated purpose the betterment of the social and economic well-being of our people by enriching their national environment of forest wealth.

As president of the Foundation, Mr. Pack initiated many important research projects. These included studies of forest management on both large and small timber properties, studies in state forestry administration, and other aspects of resource use.

Early impressed with the role that forestry might play as a means of drawing more closely together the nations of the world, Mr. Pack directed many of the activities of the Foundation toward the international phases of conservation. His organization took a leading part in establishing a forestry branch within the United Nations, and he himself was one of the founders of the Mexican Institute for Renewable Natural Resources. In recognition of his contributions in that country, Mexico conferred upon him

RANDOLPH G. PACK

honorary membership in the Mexican Society for the Protection of Nature.

In 1945 he was made an Honorary Member of the Society of American Foresters, an honor shared at that time by only three living Americans, one of them Franklin Delano Roosevelt. In 1953 he was awarded the honorary degree of Doctor of Science by the University of Michigan, in recognition of his activities in conservation and rational land management. This degree, given on the 50th anniversary of forestry teaching at the University of Michigan, read, "Industrialist, apostle of conservation. In no measure have the varied and pressing obligations of a successful business career dulled in him the concern for our forests that is characteristic of his family. Constant application to the problem of conservation and active participation in regional and national movements led him to a considered philosophy of rational land management and made his voice one needed in counsel. As president of the forestry foundation which bears the honored name of his father, he has initiated programs of research in which this University has been privileged to participate. We join with all friends of the land in recognizing the merit of one who does not take lightly the responsibilities of citizenship and has served well the common interest and the public good."

Randolph Pack's conservation activities were extensive, and included director, Northeastern Forestry Foundation; member, American Citizens Committee for the United Nations Scientific Conference on Conservation and Utilization of Resources; trustee, Conservation Foundation; and member, Ohio Forestry Association. He was president of the American Tree Association, and had been executive vice president and director of the American Forestry Association. He served as a member of the National Conservation Committee of the Boy Scouts of America. Always active in civic work, he was chairman of the Darien (Conn.) Chapter of the American Red Cross, and of the American Red Cross Fund Drive in 1942.

He had wide industrial interests, and his dual background of industry and conservation made him particularly alert to the need to translate conservation concepts into the actualities of the business world, to find ways of impressing the executive with an acceptance of the fact that his business, just as his life, was dependent on the natural resources.

But these outward interests and the honors they brought him present only a partial picture of the man himself. Perhaps his chief characteristic was kindliness, a generosity, a quickness to praise. He tried always to find your point of view, he rejoiced in your successes, and he was sympathy itself when things went bad. There was about him a bigness in admitting his own errors, and a complete willingness to readjust his plans.

He was an indefatiguable talker. He enjoyed talking, enjoyed meetings, and he had an amazing ability to seize on ideas, develop them, and put them into effect. He had a genius for friendships, and his friends covered a wide field—forestry, industry, finance, and education. He had a deep, abiding love for Mexico and a sympathy for the struggle of Mexican conservationists to stem the tide of forest destruction. He felt particulary sympathetic with the work of the Society of American Foresters, and his Foundation shared with the Society in more than one professional study. He was a loyal and effective friend of forestry. He will be greatly missed.

The activities of the Foundation will be continued under the direction of Arthur Newton Pack, who with his father established the Foundation almost thirty years ago.

Society Affairs

Officers and Council
1956-1957

DEWITT NELSON, *President*
Department of Natural Resources
315 State Office Building 1
Sacramento 14, Calif.

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Union Bag—Camp Paper Corporation
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Savannah, Ga.

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2026 St. Charles Avenue
New Orleans 13, La.

C. HUXLEY COULTER
Florida Forest Service
Tallahassee, Fla.

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New Haven 11, Conn.

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School of Natural Resources
University of Michigan
Ann Arbor, Mich.

MAURICE K. GODDARD
Department of Forests and Waters
Harrisburg, Pa.

EDWIN F. HEACOX
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Tacoma 1, Wash.

HENRY CLEPPER, *Executive Secretary*
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JOSEPH S. ILLICK
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State University of New York
Syracuse 10, N. Y.

J. HERBERT STONE
U. S. Forest Service
729 N.E. Oregon St.
Portland 8, Ore.

HENRY J. VAUX
School of Forestry
University of California
Berkeley 4, Calif.

First Call for Council Nominations

All members are hereby notified that the regular biennial election will be held December 2, 1957. A president, vice president, and nine other members of the Council will be elected for the two-year term 1958-1959.

The present Council is listed in the box above. Any or all of these incumbents may be renominated, provided they accept the nomination in writing.

President DeWitt Nelson has announced that he will not be a candidate for re-election.

Membership on the Council is restricted by the Constitution to Members (formerly Senior Members) and Fellows. Any Member or Fellow is eligible to hold office who is in good standing and who accepts the nomination in writing and declares his willingness to serve if elected.

Each voter will have an opportunity to ballot on all candidates for office. Council members are elected in accordance with the system of proportional representation. The procedure of proportional representation will be explained in a later issue of the JOURNAL. It is the system by which the Society has been electing Council members for over two decades.

Candidates for the office of president are voted on separately; the candidate who receives the highest vote is declared elected president, and the candidate who receives the next highest vote is declared elected vice president.

How Nominations Are Made

The Constitution (Article VIII, Section 2) states the conditions under which nominations are made by petition.

1. Each petition shall name but one candidate.

2. All candidates must be eligible to hold elective office.

3. A petition shall bear the signatures of at least ten voting members who at the time of signing the petition are eligible to vote in the coming election. (Eligible voting members are Junior Members, Members, and Fellows in good standing.)

4. A voting member may not sign more than one nominating petition for president or more than one nominating petition for a member of the Council. That is, he may sign two, but no more.

5. Petitions must be in the Society office by September 18, 1957.

The Society has no special form for submitting nominating petitions. They may be written as follows:

We, the undersigned voting members of the Society of American Foresters, hereby nominate John Doe, a Member (or Fellow) for the office of president (or member of the Council) for the two-year term 1958-1959.

All nominating petitions should be sent promptly to the Society office. The executive secretary will gladly provide information about nominating or election procedure.

According to the Constitution (Article VIII, Section 1) a Nominating Committee has been appointed by President Nelson. The Committee is composed of the following members:

Chairman, J. H. Johnson, Chesapeake Corp. of Virginia, Box 534, West Point, Va.

S. T. Carlson, National Park Service, P. O. Box 1728, Santa Fe, N. Mex.

Albert Engstrom, Oklahoma Division of Forestry, Capitol Building, Oklahoma City, Okla.

James E. Sowder, Deschutes Research Center, U. S. Forest Service, Bend, Ore.

Harry E. Troxell, School of Forestry, Colorado A & M College, Fort Collins, Colo.

This committee is charged with the following duties:

1. To set the date of the election. (December 2, 1957 is the date.)

2. To provide for at least two candidates for the office of president, and at least nine candidates for membership on the Council.

3. To receive separate nominating petitions for the office of president and for each member of the Council, and to supplement such petitions when

TABLE 1.—DISTRIBUTION OF COUNCIL MEMBERS BY STATES DURING PERIOD 1942-1957
(Presidents' names are in capital letters; vice presidents', in italics)

State	1942-1943	1944-1945	1946-1947	1948-1949	1950-1951	1952-1953	1954-1955	1956-1957
Alabama	Smith, H. A.							
California	Baker, F. H.	Baker, F. H.		Nelson, DeWitt	Porter, Earl Nelson, DeWitt	Porter, Earl Thompson, P. A.	*Nelson, DeWitt*	Nelson, DeWitt Vaux, H. J.
	Keen, F. P.	Keen, F. P.						
Colorado	Peck, A. C.			Spencer, J. W.				*Garratt, G. A.*
Connecticut	Hawley, R. C.	Hawley, R. C.						
Dist. of Columbia	Behre, E. C.			McArdle, R. E.	McArdle, R. E.	McArdle, R. E.		
Florida							Coulter, C. H.	Coulter, C. H.
Georgia			Evans, C. F.	*Evans, C. F.*	EVANS, C. F.			Allen, B. E.
Idaho			Evenden, J. C.	Evenden, J. C.				
Illinois			Coffman, J. D.					
Louisiana	Eldredge, I. F.							
Maine					Demeritt, D. B.	Demeritt, D. B.	Demeritt, D. B.	Briegleb, P. A.
Michigan	*Allen, S. W.*	*Allen, S. W.*	ALLEN, S. W.		Fontanna, S. G.		Fontanna, S. G.	Fontanna, S. G.
Minnesota	SCHMITZ, H.	SCHMITZ, H.			Kaufert, F. H.	Kaufert, F. H.		
Missouri						Westveld, R. H.	Westveld, R. H.	
Montana	Gisborne, H.	Smith, G.					Hanson, P. D.	
New Hampshire			Herr, C. S.	Herr, C. S.	*Herr, C. S.*			
New Mexico					Lindh, C. O.	Lindh, C. O.		
New York	Howard, W. G.	Recknagel, A. B.	Recknagel, A. B.				Illick, J. S.	Illick, J. S.
North Carolina		Damtoft, W. J.	Damtoft, W. J.			*Demmon, E. L.*	DEMMON, E. L.	
Oregon		Dunn, P. M.	Dunn, P. M.	Dunn, P. M.	Brundage, F. H.		Stone, J. H.	Stone, J. H.
Pennsylvania		Shirley, H. L.						Goddard, M. K.
South Carolina				Flory, C. H.				
Tennessee				Baker, W. M.				
Washington		Greeley, W. B.	Greeley, W. B.	Greeley, W. B.	Markworth, G.	DRAKE, G. L.	Heacox, E. F.	Heacox, E. F.
			Martin, C. S.	MARTIN, C. S.		Markworth, G.		
Wisconsin		Price, J. H.	Price, J. H.			Brown, W. J.	Brown, W. J.	

necessary with other nominations in order to comply with item 2 above.

The Nominating Committee will make no nominations of its own unless the voting membership fails to make the required minimum number of nominations by petition. Voting members should accordingly get busy and make their own nominations. For their information the distribution of Council members by states during the period 1942-1957 is shown in Table 1.

A petition has already been received, placing Henry J. Malsberger of Atlanta, Ga., in nomination for the office of president.

J. H. JOHNSON, *chairman*
Nominating Committee

First Call for Fellow Nominations

All Members (formerly Senior Members) and Fellows of the Society are hereby advised that nominations for the grade of Fellow are now open. The election of Fellows will be held at the time of the Society's regular biennial election, December 2, 1957.

As defined by the Constitution (Article III, Section 7), "Fellows shall be foresters of outstanding achievement as leaders in responsible directive or distinctive individual work of a fruitful character. They shall be elected from the Members and shall be engaged in forestry work at the time of their election."

Nominations by Petition

The procedure for placing Members in nomination for the grade of Fellow is by petition. The Society has no printed form for this purpose; the petition may be typewritten thus:

We, the undersigned Members and Fellows of the Society of American Foresters, hereby nominate John Doe for election to the grade of Fellow in 1957.

Remember these simple rules:

1. A petition may not name more than one candidate.

2. It must be signed by 25 Members or Fellows in good standing.

3. It should be accompanied by a factual, not eulogistic, biographical sketch of at least 200 words giving an account of the nominee's professional career and accomplishments.

4. It must be received in the executive office of the Society in Washington, D. C., not later than September 18, 1957.

The executive employees of the Society cannot be responsible for obtaining signatures on partially completed petitions or on petitions incomplete by reason of unacceptable signatures (that is, signatures of other than Members and Fellows in good standing).

Election Procedure

Fellows are not elected by the membership at large, but by a board of electors which consists of all present Fellows and the present Council. (A Council member who is also a Fellow has but one vote.)

The system is described in Article IV, Section 4 of the Constitution. To win election a candidate must receive an affirmative vote of not less than one-half the total votes cast.

During 1957, the voting membership of the Society will have an opportunity to ballot on a proposal by the Council that would increase the number of Fellow electors. If the referendum is approved, the chairmen of the 21 Sections and the chairmen of the 11 subject Divisions, a total of 32 electors, will cast votes for Fellows in addition to the present Fellows and the Council. For a detailed discussion of this proposal members are referred to the JOURNAL for April 1956, page 279, and for June 1956, page 410.

Significance of the Grade

The highest membership distinction that can be conferred by the Society, this grade is awarded in recognition of outstanding achievement. Fellows do not pay increased dues; their dues are the same as those of Members.

Since the Society was founded in 1900, there have been 109 Fellows elected. At the present time the number of living Fellows is 69.

Since the last election in December 1955, three Fellows have died: William B. Greeley, Walter Mulford, and Raphael Zon.

List of Fellows

The current roster of Fellows follows. The state in which each Fellow is domiciled and the year of his election are shown after his name.

Allen, Shirley W. Michigan. 1948.
Bailey, Reed W. Utah. 1955.
Baker, Frederick S. California, 1949.
Besley, Fred W. Maryland. 1940.
Boyce, John S. Connecticut. 1955.
Brundage, Frederick H. Oregon. 1949.
Butler, Ovid. Maryland. 1940.
Carter, E. E. District of Columbia. 1942
Chapman, Herman H. Connecticut. 1922.
Clapp, Earle H. District of Columbia. 1930.
Clepper, Henry E. Virginia. 1949.
Coffman, John D. California. 1946.
Cox, William T. Minnesota. 1953.
Curran, Hugh. Venezuela. 1951.
Damtoft, Walter J. North Carolina. 1951.
Dana, Samuel T. Michigan. 1935.
Demeritt, Dwight B. Maine. 1955.
Demmon, Elwood L. North Carolina. 1951.
Detwiler, Samuel B. Colorado. 1955.
Drake, George L. Washington. 1953.
Eldredge, Inman F. Lousiana. 1942.
Evans, Charles F. Georgia. 1949.
Evenden, J. C. Idaho. 1953.
Ferguson, J. A. Pennsylvania. 1949.
Fischer, Arthur F. California. 1940.
Fontanna, Stanley G. Michigan. 1955.
Fritz, Emanuel. California. 1951.
Frothingham, E. H. California. 1942.
Garratt, George A. Connecticut. 1953.
Gill, Tom. District of Columbia. 1948.
Granger, Christopher M. Maryland. 1946.
Guise, Cedric H. New York. 1951.
Guthrie, John D. Virginia. 1942.
Hall, J. Alfred. Wisconsin. 1955.
Hall, William L. Arkansas. 1940.
Hartley, Carl P. Maryland. 1949.
Hawes, Austin F. Connecticut. 1939.
Hawley, Ralph C. Connecticut. 1942.
Heintzleman, B. Frank. Alaska. 1951.
Holmes, J. S. North Carolina. 1939.
Hosmer, Ralph S. New York. 1932.
Hunt, George M. Wisconsin. 1951.
Illick, Joseph S. New York. 1946.
Isaac, Leo A. Oregon. 1953.
Jeffers, Dwight S. Oregon. 1948.
Kaufert, Frank H. Minnesota. 1955.
Keen, Frederick P. California. 1955.
Kelley, E. W. California. 1949.
Kellogg, Royal S. Florida. 1949.
Kinney, Jay P. New York. 1942.
Kittredge, Joseph. California. 1953.
Korstian, Clarence F. North Carolina. 1942.
Krueger, Myron E. California. 1951.
Lowdermilk, Walter C. California. 1948.
MacDonald, G. B. Iowa. 1944.
Marekworth, Gordon D. Washington. 1955.
Marsh, Raymond E. District of Columbia. 1948.
Martin, Clyde S. Washington. 1948.
Mason, David T. Oregon. 1948.
McArdle, Richard E. District of Columbia. 1953.
Metcalf, Woodbridge. California. 1953.
Morrell, Fred W. Virginia. 1951.
Munger, Thornton T. Oregon. 1946.
Munns, Edward N. California. 1949.
Preston, John F. District of Columbia. 1948.
Price, Jay H. Arizona. 1951.
Schmitz, Henry. Washington. 1940.
Shirley, Hardy L. New York. 1951.
Show, S. B. California. 1948.
Siecke, E. O. Texas. 1946.
Sparhawk, William N. New Hampshire. 1946.
Watts, Lyle F. Oregon. 1946.
Winslow, C. P. Washington. 1942.
Wirt, George H. Pennsylvania. 1948.
Ziegler, E. A. Pennsylvania. 1949.

The President's Column

It Can Happen Again

DEWITT NELSON

Thirty to sixty miles per hour winds, relative humidity of 7 percent at the ocean edge, steep coastal mountains covered with chaparral interspersed with hundreds of homes—to this explosive combination add the element of fire. Heavy watershed cover, plus extreme fire weather conditions, plus steep topography, plus thousands of people, plus fire spreading at the rate of 2,000 acres per hour and the result is a full scale dress rehearsal of what can happen in any one of many areas in event of enemy attack.

Such was the setting for the five fires in Los Angeles and Ventura Counties of southern California between Christmas and New Year's Day. These fires were dramatically headlined by newspapers, radio and television from coast to coast. They burned a total of about 40,000 acres and were placed under control within four days. During the same period dozens of other fires started throughout the area under similar burning conditions but were contained at smaller acreages.

On the two major fires in the Malibu Mountains of Los Angeles County most of the work during the first twenty-four hours had to be concentrated on saving lives and homes. In all of these fires ninety-four homes were lost but hundreds were saved under the most perilous conditions. One man lost his life because he returned home in violation of evacuation instructions.

Every emergency organization went into action under prior "Mutual Aid" arrangements. County, city, state, and federal forest protection agencies; sheriffs and highway patrol; federal, state, and county civil defense organizations; and the American Red Cross and others. The Governor declared a State of Emergency and the President declared a Disaster Area. The Marines, Navy, and Air Force joined in the fire fighting task. The spirit of cooperation and the degree of coordination was superb. There was one

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common objective and all joined together to accomplish it with a minimum cost of life and property in a minimum of time.

What lessons can be learned from this experience?

In this Mediterranean type of country this is not an unusual situation. Therefore, the many agencies frequently have need of working together in coordinated action. This is an experience which every protection organization should embrace at every opportunity. By so doing they will be ready when and where the emergency occurs.

The impact of population and the development of wildland areas with homes, business houses, and industries creates an entirely new problem for the forest fire fighter. In such areas he no longer confines his work to the perimeter of the fire. He must also take great risks and protect lives and property inside the fire. This demands more tank truck equipment and new techniques. Here again development in wildland areas is not limited to southern California. It is taking place in areas all across the country. One can see it developing even in sparsely populated areas of many states. A disastrous fire struck Maine back in 1947. Can it happen in your area?

Two of the California fires started from unknown causes in the night and took off with running starts. The first was discovered and reported by an airways pilot. How can we improve our detection system so that it works while people sleep?

How can we make fire prevention more effective? I know of no large group of citizens who are more fire conscious than the six million living in southern California, yet every year we have many fires starting because of carelessness or thoughtlessness. Incendiary fires are relatively rare. How can we prevent these man-caused fires? Can research give us new approaches to the problem? I believe it is time that we search for methods and techniques that we may have been overlooking.

How can we "take some of the heat" out of our forests and watersheds? How can we rapidly contain run-a-way fires which every few minutes release energy equivalent to the Hiroshima A bomb? Can science and research give us answers? Some progress was made this year in aerial chemical bombing. If scientists can crack the atom they should be able to smother a fire.

More research in fire defense is needed. Until research produces solutions we'll keep on fighting them the hard way. When the chips are down the job is usually bigger than any single organization so I urge that all agencies and allied industries take advantage of every opportunity to work together on this job. It is bound to pay off.

De Will Nelson

Refugee Hungarian Foresters Seek Employment in U. S.

The National Academy of Sciences is attempting to assist placing refugee Hungarian scientists and professional workers in self-supporting positions in the country. Among these refugees are several foresters.

One of the early arrivals was Mr. Ferenc Vass, a forest engineer with a diploma from the Technical University of Hungary granted in 1944. His age is 35, he speaks German and French in addition to Hungarian, and has a wife and child. He has been a forest supervisor in Hungary, was for four years prior to his escape an associate professor at the University, and has published two books on forest machines and forest transport.

Any prospective employer who might be able to place Mr. Vass or any of the other refugee foresters should write to the National Academy of Sciences placement unit, Building 1305, Camp Kilmer, N. J. The telephone is CHarter 9-5883, extensions 22, 23, and 24.

Zon Historical Material Sought

Raphael Zon, one of the great men in American and world forestry, died last October. Plans are being developed for a biography of his life.

The S.A.F. Committee on Forestry History has undertaken to assemble all manner of material pertaining to

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Zon in private hands. Especially wanted are personal letters and correspondence; manuscripts, particularly those containing his marginal notes or comment; notes used in speeches or lectures or reports of these; notes on conversations or conferences in which he took part; and the like. Also desired are photos or snapshots in which Zon appears. These should be dated as closely as possible. Where others appear in the photo, they should be identified if possible.

Any such material which can be spared should be sent either to the executive secretary of the Society in Washington, D. C., or to E. N. Munns, 1639 Garnet Lane, Concord, Calif.

Suggestions as to sources of material which might be overlooked or not otherwise reached by this request are welcomed. Any restrictions on the possible public use of this material will be honored, and if requested, any material or photos will be promptly returned to the sender.

E. N. MUNNS, *Chairman,*
Committee on Forestry History

Coming Events

North American Wildlife Conference

The 22nd North American Wildlife Conference will be held March 4-6, 1957, in the Statler Hotel, Washington, D. C.

Columbia River Section

A meeting of the Columbia River Section will be held March 30 at the Marion Hotel, Salem, Ore.

Gulf States Section

The Gulf States Section will hold its 1957 meeting at the Jung Hotel, New Orleans, La., on May 9 and 10.

Forest Products Research Society

F.P.R.S. will hold its national meeting June 24-27, 1957 in Buffalo, N. Y.

Arthur H. Zimmerman (1905-1956)

Arthur H. Zimmerman, 51 died in December at his home in East Stroudsburg, Pa.

Mr. Zimmerman was employed for 19 years in the Department of Forestry Relations, TVA, Norris, Tenn.

He began his forestry career with the Pennsylvania Department of Forests and Waters in 1929, after graduation from Penn State School of Forestry that year.

He had been a member of the SAF since 1931.

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Education Committee Reviews Accreditation Standards

Through its chairman, H. G. Wilm, the Society's Committee for the Advancement of Forestry Education reports that it is actively engaged in a review of the present standards for accrediting forestry schools.

The object of this review is to find and remove any existing flaws in the established procedures, and in general to raise the required standards for the accreditation of any school of forestry. The committee believes that the forestry school must have the faculty and facilities to be able to offer a well-rounded program of education in professional forestry, and that this program be backed up by adequate instruction in all of the necessary basic fields.

Kentucky-Tennessee Section Meets

The Kentucky-Tennessee Section of the Society of American Foresters, held their annual meeting December 7 and 8, 1956, at Cumberland Falls State Park in Kentucky. Eighty members registered for the two day session. Two panel discussions highlighted the meeting. Charles Cheston of the University of the South moderated the opening panel on Foresters for the Future. An afternoon panel on promoting use of wood was led by E. A. Clevenger, vice-president of the Corley Manufacturing Company.

Banquet speaker was Kentucky's Commissioner of Conservation Laban Jackson. Another banquet feature was the annual presentation of Forestry Recognition Awards to a layman of each state who has contributed the most to forestry. Recipients this year for Kentucky was Harriet Grannis, of Flemingsburg: for Tennessee S. A.

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Robert of Jackson. John Hinton of Chattanooga presented the awards and summarized the accomplishments and contribution of both award winners. The consensus of opinion is that such awards are one of the most important activities the Section has undertaken.

In a business session, officers for the coming year were installed as follows:

Chairman—Robert F. Collins, U. S. Forest Service, Winchester, Ky.

Vice chairman—Russell Stadelman, Nickey Bros., Inc. Memphis, Tenn.

Secretary-Treasurer—James A. Newman, University of Kentucky, Lexington, Ky.

Other section business included committee reports. A decline of 17 members during the past year was recorded, leaving section membership at 217. The loss occured in the Junior Member grade.

Harry Nadler, Kentucky Division of Forestry, made all the arrangements for the banquet and program.

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Puget Sound Section Campaigns Against Illegal Christmas Tree Cutting

The Puget Sound Section of the Society of American Foresters preceded the past Christmas Season with a publicity campaign directed at the general public to encourage the law-abiding acquisition of Christmas trees. Theme of the campaign under the direction of Jay Gruenfeld, Section Education Committee chairman, was "Protect our Forests—don't celebrate Christmas with a stolen Christmas tree." The campaign pointed out the damage resulting from unauthorized and unplanned cutting of trees on federal, state, and private lands and highlighted the importance of productive forests in Washington's economic future. It pointed out that cutting trees without permission was contrary to the spirit of the holiday.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatements received in the Society office during the month of December are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of March 1, 1957. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Baldwin, R. C. DeBald, P. S.
Breslin, T. A. Truitt, W. W.

WEST VIRGINIA UNIVERSITY

Howard, R. L. Sadie, A. E.
Kiser, A. W.

Junior Grade

Campbell, R. W., Helicopter Utility Sqdn., Naval Air Sta., Lakehurst, N. J.; State Univ. of N. Y., B.S.F., 1953.

Coy, R. M., Forester, Dept. of Forests & Waters, Bloomsburg, Pa. Reinstatement.

Kaczynski, H., Asst. Forester, N. J. Dept. Cons. & Eco. Dev., Trenton, N. J.; N. C. State, B.S.F., 1947.

Radomsky, R., Asst. Forester, Pa. Dept. of Forests & Waters, Port Kennedy, Pa.; Pa. State, B.S.F., 1956.

Schutz, A. S., Forester, U.S.F.S., Bethlehem, Pa.; Pa. State, B.S.F., 1953.

Stralka, R. J., Forester, Dept. of Forest & Waters, Scranton, Pa.; Pa. State, B.S.F., 1952.

Member Grade

Burr, H. L., Forester, Timber Products

Inc., Cairo, W. Va.; W. Va. Univ., B.S.F., 1951. (Junior 1952).

Kronk, M. E., Chief, Mapping Div., L. R. Kimball, Consulting Engineer, Ebensburg, Pa.; Pa. State, B.S.F., 1952. (Junior 1952).

Matics, H. E., Forester-General Mgr., Timber Products, Inc., Cairo, W. Va.; W. Va. Univ., B.S.F., 1951. (Junior 1951).

Muhlenberg, N., Forester, Crown Zellerbach, Wyomissing, Pa.; Univ. of Mich., M.F., 1952. (Junior 1952).

Vesper, C. A., Forester, Pa. Bureau of Correction, Bellefonte, Pa. (Junior 1950).

Appalachian Section

Member Grade

Altman, J. A., Forester, Starmount Co., Greensboro, N. C. (Junior 1950).

Anderson, R. F., Assoc. Prof., Duke Univ., Durham, N. C. (Junior 46R51).

Boswell, A. W., Forester, M. C. Braswell Co., Battleboro, N. C. (Junior 1950).

Broadway, C. A., Consulting Forester, Spartanburg, South Carolina. (Junior 1950).

Davis, T. S., Forester, U. S. Army, Fayetteville, N. C. (Junior 1950).

Dellinger, H. C., Unit Forester, International Paper Co., Georgetown, S. C. (Junior 1950).

Dowdell, S. A., Dist. Forester, N. C. State Forest Service, Elizabeth City, N. C. (Junior 1950).

Elliott, R. E., Dist. Ranger, U.S.F.S., Bridgewater, Va. (Junior 33R55).

Ennis, J. J., Div. Forester, Champion Paper & Fibre Co., Asheville, N. C. (Junior 1950).

Flickinger, H. H., Regional Mgr., International Paper Co., Georgetown, S. C. (Junior 1950).

Geddes, R. B., Forester, Va. State Forest Service, Tappahannock, Va. (Junior 1950).

Gravely, J. A., Forester, Ga.-Pacific Plywood Co., Brevard, N. C. (Junior 1950).

Green, H. J., Pest Control Forester, N. C. State Forest Service, Raleigh, N. C. (Junior 1950).

Greene, M. F., Supv., Siebel Bruce & Co., Columbia, S. C. (Junior 1950).

Hamilton, J. R., Graduate Asst., N. C. State, N. C. (Junior 1950).

Hofmann, J. G., Forester, Halifax Paper Co., Roanoke Rapids, N. C. (Junior 1950).

Mulkey, M. A., Student, N. C. State, Raleigh, N. C. (Junior 1950).

Pekar, M. A., Forester, Continental Can Co., Palmyra, Va. (Junior 1950).

Perkins, E. G., Industrial Forester, N. C. State Forest Service, Raleigh, N. C. (Junior 1950).

Pierce, W. L., Dist. Fire Chief, Va. State Forest Service, Portsmouth, Va. (Junior 1950).

Plotkin, H., Dist. Forester, N. C. State Forest Service, Fayetteville, N. C. (Junior 1950).

Rankin, J. R., Area Forester, Turnell & Morgan, New Bern, N. C. (Junior 1950).

Rogers, G. L., Wood Procurement & Field Rep., N. C. Pulp Co., Plymouth, N. C. (Junior 1950).

Sedlock, E. J., Cartographer, U.S.F.S., Alexandria, Va.; Mich. State, M.S., 1953. (Junior 1953).

Smith, G. W., Grad. Asst., N. C. State, Raleigh, N. C. (Junior 48R54).

Spivey, J. F., County Forester, N. C. State Forest Service, Greensboro, N. C. (Junior 1950).

Speers, C. F., Entomologist, Southeastern Forest Expt. Sta., Asheville, N. C. (Junior 1950).

Wilson, A. D., Dist. Mgt. Chief, Va. State Service, Farmville, Va. (Junior 1950).

Central Rocky Mountain Section

Junior Grade

Newlon, C. J., Dist. Forester, Colo. State Forest Service, Fort Collins, Colo.; Colo. A & M, B.S.F., 1956.

Watson, H. N., Dist. Ranger, U.S.F.S., Dubois, Wyo.; Colo. A & M, B.S.F., 1948.

Central States Section

Junior Grade

Marek, K., 2749 S. Homan Ave., Chicago, Ill.; Purdue, B.S.F., 1956. (Student 1955).

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Cory, W. N.
Greenup, M.
Harden, C. H.
Pryor, R. A.
Wittwer, H. J.

Junior Grade

Burks, J. E., Heckart Lodge, Corvallis, Ore.; Ore. State, B.S.F., 1956. (Student 1955).

Chamberlain, R. L., Forester, S. D. S. Lumber Co., Bingen, Wash.; State Univ. of N. Y.; B.S.F., 1952.

Member Grade

Andringa, J. J., Forester, U. S. Plywood, Inc., Eugene, Ore.; Ore. State, B.S.F., 1951. (Junior 1951).

Carlson, D. R., River Scaler, Crown Zellerbach Corp., Seaside, Ore.; Univ. of Wash., B.S.F., 1951 .(Junior 1951).

Goedhard, A., Inventory Forester, Weyerhaeuser Tbr. Co., Longview, Wash.; Ore. State, B.S.F., 1953. (Junior 1953).

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Bonner, F. T.
Capel, J. C.
Carpenter, B. E.
Haarala, G. R.
Hinson, M. R.
Johnson, F. J.
Krause, C. M.
Marcus, C. A.
Monk, J. R.

Junior Grade

Bates, W. C., Asst. Forester, Texas Forest Service, Kirbyville, Texas; Mich. State College, B.S.F., 1947

Member Grade

Miller, R. R., Hardwood Silviculturist, Gaylord Container Corp., Bogalusa, La.; Iowa State, B.S.F., 1951; Duke, M.F., 1956. (Junior 1951).

Affiliate Grade

Jones, R. D., Dist. Forester, International Paper Co., Pearlington, Miss.

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Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Schwab, J. R.

Member Grade

Anderson, J. W., Mgmt. Forester, Inland Empire Paper Co., Millwood, Wash. (Junior 1950).

Bielejac, J. H., Forester, Potlatch Forest Inc., Lewiston, Idaho. (Junior 1950).

Burlison, V. H., Extension Forester, Univ. of Idaho, Moscow, Idaho. (Junior 1950).

Cochran, W. G., Forester, Milwaukee Railroad, St. Maries, Idaho. (Junior 47R55).

Damon, R. W., Ranger, U.S.F.S., Avery, Idaho. (Junior 1950).

Enke, W. C. A., 402 D Street, Grangeville, Idaho. (Junior 1949).

Fagan, J. H., Industrial Forester, Potlatch Forest Inc., Orofino, Idaho. (Junior 1950).

Frazier, G., Forester, Potlatch Forest Inc., Headquarters, Idaho. (Junior 1950).

Gillette, J. E., Dist. Forester, State of Idaho, St. Maries, Idaho. (Junior 1950).

Graham, D. P., Research Forester, U.S.F.S., Spokane, Wash. (Junior 1950).

Hareh, W. A., Forester, U.S.F.S., Orofino, Idaho. (Junior 1950).

Lyman, J. R., Forest Service, Grangeville, Idaho. (Junior 1950).

McGaw, W., Forester, Potlatch Forest Inc., Headquarters, Idaho. (Junior 1950).

Mitchell, W. J., Forest Service, St. Maries, Idaho. (Junior 1950).

Nousianen, A. O., Forest Ranger, U.S.F.S., Bonners Ferry, Idaho. (Junior 49R55).

Satterlee, R. E., Forest Service, Inchelium, Wash. (Junior 1950).

Scribner, W. A., Forester, State of Idaho, Moscow, Idaho. (Junior 1950).

Williams, E. L., Forester, Pugh Lbr. Co., Springston, Idaho. (Junior 1950).

Intermountain Section

Student Grade

UTAH STATE AGRICULTURAL COLLEGE

Brown, R. E. Cadzow, G. A.

Kentucky-Tennessee Section

Junior Grade

Benson, H. G., Service Forester, Tenn. Dept. of Cons., Dresden, Tenn.; Mont. State, B.S.F., 1940.

Logan, A. J., Asst. Forest Supv., U.S.F.S., Cleveland, Tenn.; Hendrix College, B. A., (Chemistry & Biology), 1933. (Affiliate 1953).

Pierce, L. A., Forester, U.S.F.S., London, Ky.; Univ. of Mass., B.S.F., 1954.

Member Grade

Allen, J. C., Asst. Dist. Forester, Tenn. Forestry Div., Harriman, Tenn. (Junior 1950).

Buchholz, J. A., 151 Beaumont Ave., Frankfort, Ky. (Junior 1950).

Butcher, G. L., Ky. Div. of Forestry, Georgetown, Ky. (Junior 1950).

Disney, W. L., 825 4th St., Corbin, Ky. (Junior 1950).

Faris, E. T., Rt. 5, Athens, Tenn. (Junior 1950).

Fromme, J. T., U.S.F.S., London, Ky. (Junior 1950).

Gates, P. J., Woods Dept., Mead Corp., Kingsport, Tenn. (Junior 1950).

Grafton, C. F., Vice President, Chapman Chemical Co., Memphis, Tenn.; Univ. of Minn., B.S.F., 1937 (Junior 1951).

Hasek, J. M., Pinelawn Ave., Chattanooga, Tenn. (Junior 1949).

Heavrin, C. A., Forester, Anderson-Tully Lbr. Co., Dyersburg, Tenn. (Junior 1950).

Johnson, J. C., Forest Products, E. L. Bruce Co., Memphis, Tenn. (Junior 1950).

Markham, T. M., Supt. Tenn. Div. of Forestry, Jackson, Tenn. (Junior 41R54).

Meekins, E. H., Box 374, Williamsburg, Ky. (Junior 36R56).

Nix, L. C., Rt. 3, Tellico Plains, Tenn. (Junior 1950).

Olive, C. L., Div. of Forestry Relations, T.V.A., Paris, Tenn. (Junior 1950).

Reynolds, E. E., I & E, Ky. Div. of Forestry, Morehead, Ky. (Junior 1950).

Roach, B. A., 48 Prospect, Berea, Ky. (Junior 1950).

Simpson, J. P., 119 Cherrydale Circle, Greeneville, Tenn. (Junior 1950).

Sterrett, J. P., 2727 Terrace Blvd., Ashland, Ky. (Junior 1950).

Zarger, T. G., Div. of Forestry Relations, T.V.A., Norris, Tenn. (Junior 1950).

Associate Grade

Hawkins, L. C., Purchasing Agent, Southern Wood Preserving Co., Chattanooga, Tenn.

New England Section

Student Grade

UNIVERSITY OF MAINE

Payne, F. J. Whitham, L. C.

Putnam, E. L.

Junior Grade

Becking, R. W., Asst. Prof., Univ. of N. H., Durham, N. H.; Univ. of Wash, Ph.D., 1954.

Hunter, J. E., 64 Palfrey Road, Belmont, Mass.; Univ. of Maine, B.S.F., 1954.

Member Grade

Adams, W. J., Service Forester, Maine Forest Service, Readfield, Maine. (Junior 1950).

Babb, J. R., Salesman, Winde-McCormick Lbr. Co. S. Portland, Maine. (Junior 1950).

Blaisdell, G. M., Supt. of Woodlands, International Paper Co., North Livermore, Maine. (Junior 1950).

Bork, J. H., Dist. Logging Supt., Brown Co., Berlin, N. H. (Junior 48R50).

Brown, C. L., Research Asst., Cabot Foundation, Cambridge, Mass. (Junior 1950).

Chitty, M. L., Forester, Penobscot Dev. Corp., Dover-Foxcroft, Maine. (Junior 49R55).

Church, C. J., Purchasing & Sales, Woodstock Lbr. & Allied Products Inc., Amesbury, Mass. (Junior 1950).

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Crosby, D., Research Entomologist, Northeastern Forest Expt. Sta., New Haven, Conn. (Junior 47R55).
Elwert, F. P., Dist. Forester, New England Forestry Foundation, Rutland, Vt. (Junior 1950).
Fiske, L. M., Self employed, 15 Brookside Ave., Greenfield, Mass. (Junior 1950).
Foster, R. W., Grad. Student, Yale, New Haven, Conn. (Junior 1950).
Hall, S. G., Resident Mgr., Draper Corp., Plymouth, N. H. (Junior 1948).
Hunt, F., Owner, New England Silvicultural Service Inc., Petersham, Mass. (Junior 1950).
McNally, J. A., Resident Mgr., Canadian International Paper Corp., Quebec, P. Q., Canada. (Junior 1950).
Nelson, C. L., Asst. Supt., Great Northern Paper Co., Greenville, Maine. (Junior 1950).
Norcott, K. S., Chief Forester, Brown Co., Berlin, N. H. (Junior 1950).
Ohlson, V., Forester, U.S.F.S., Norway, Maine. (Junior 1950).
Orach, S., Service Forester, S. D. Warren Co., Gorham, Maine. (Junior 1950).
Paine, L. A., Forest Pathologist, Laval Univ., Quebec, P. Q., Canada. (Junior 44R53).
Russ, D. F., Forester-in-charge, Great Mountain Forest, Norfolk, Conn. (Junior 1950).
Wade, I. W., Appraiser, U. S. Fish & Wildlife Service, Billerica, Mass. (Junior 1950).
Walker, B. C., Lumber yard foreman, Ellsworth Builders Supply Co., Ellsworth, Maine. (Junior 1950).
Winn, M. S., Forester, Glastenbury Timberlands, Inc., Bennington, Vt. (Junior 46R56).
Young, K. E., Vice President, Machias River Lbr. Co., Cape Elizabeth, Maine. (Junior 1950).

Affiliate Grade

Woodward, E. C., Grad. Research Asst., Univ. of N. H., Durham, N. H.; Paul Smith's, A.A.S., (Forest Tech.), 1952.

Associate Grade

McGahan, M. W., Asst. Prof., Univ. of R. I., Kingston, R. I.; Univ of Calif., A.B., (Biology), 1948; Ph. D., 1952.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Butzer, S. D.
Carlin, J. C.
Farr, W. A.
Greve, N. F.
Hunter, K. C.
Miller, C. R.
Sand, P. R.
Schenck, W. O.
Shaw, J. H.
Tegethott, A. C.
Thomas, D. R.
Ulmer, W. G.
Zeh, B. E.

Junior Grade

Sloat, E., Asst. Deputy State Forester, Calif. Div. of Forestry, Santa Rosa, Calif.; Univ. of Calif., B.S.F., 1937.

Northern California Section

Member Grade

Andrews, W. B., Asst. Dist. Forester, Southern Pacific Land Co., Grass Valley, Calif.; Univ. of Calif., B.S.F., 1952. (Junior 1952).
Bailey, E. B., Assoc. State Forest Ranger, State Div. of Forestry, Sacramento, Calif.; Univ. of Wash., B.S., 1951. (Junior 1951).
Crossfield, F. E., Asst. State Forest Ranger, State of Calif., Sutter Creek, Calif.; Univ. of Calif., B.S.F., 1951. (Junior 1951).
Graham, H., Timber Mgt. Asst., U.S.F.S., Sawyers Bar, Calif.; Univ. of Calif., B.S.F., 1951 (Junior 1951).
Gustafson, R. W., Forester, U.S.F.S., Redding, Calif.; Univ. of Calif., B.S.F., 1950. (Junior 1951).
Landenberger, C. F., Field Rep., Calif. Redwood Asso., Eureka, Calif.; Colo. A & M, B.S.F., 1948; M.F., 1949. (Junior 1950).
Lendman, F. N., Forester, R. G. Watt, Redding, Calif.; Iowa State, B.S.F., 1950. (Junior 1951).
Lockett, T., Tbr. Cruiser, Self employed, Eureka, Calif.; Univ. of Wash., B.S.F., 1948. (Junior 1951).
Smith, H. E., Tree Surgeon, Self employed, Carmel, Calif.; Univ. of Wash., B.S.F., 1949. (Junior 1953).

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Duft, J. F.
Johnson, J. M.
Stoleson, R. M.

Member Grade

Mart, R. M., 814 Dove Street, Glendine, Mont. Reinstatement.

Ozark Section

Junior Grade

Penn, J. F., Field Asst., International Paper Co., Malvern, Ark.; Colo. A & M., B.S.F., 1955.

Member Grade

Brooks, W. B., Forester, U.S.F.S., Hector, Ark.; Univ. of Mich., B.S.F., 1952 (Junior 1952).
Bullock, W. R., Chief Forester, Deltic Farm & Tbr. Co., El Dorado, Ark.; A.P.I., B.S.F., 1949. (Junior 1951).
Hadacek, A. F., Forester, U.S.F.S., Hot Springs, Ark.; Iowa State, B.S.F., 1950. (Junior 1951).
Liechti, W. M., Dist. Forester, Dierks Forest Inc., Nashoba, Okla.; Univ. of Mo., B.S.F., 1950. (Junior 1951).

Affiliate Grade

Plummer, H. W., Forest Tech., International Paper Co., Malvern, Ark.;

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Stuckey, H. J., Field Asst., International Paper Co., Malvern, Ark.; Ark. A & M, B.S., (Forestry), 1952.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Jarvis, M. B. Russell, D. L.

Junior Grade

Shea, K. R., Forest Pathologist, Weyerhaeuser Tbr. Co., Centralia, Wash.; Univ. of Minn., B.S.F., 1950.

Member Grade

Storkman, A. A., Forester, St. Paul & Tacoma Lbr. Co., Tacoma, Wash.; Univ. of Wash., B.S.F., 1950. (Junior 1951).

Associate Grade

Rediske, J. H., Plant Physiologist, Weyerhaeuser Tbr. Co., Centralia, Wash.; State College of Wash., B.S., (Botany), 1943; M.S., (Plant Physiology), 1948; Ph.D., 1950.

Southeastern Section

Student Grade

UNIVERSITY OF GEORGIA

Bacon, W. S. Jones, H. H.
Burgess, J. M. Purcell, J. H.
Canada, C. C. Robertson, J. A.
Clemens, K. G. Wall, R. T.
Harden, H. B.

Junior Grade

Corthell, R. E., Realty Asst., U. S. Fish & Wildlife Service, Atlanta, Ga.; Ore. State, B.S.F., 1948.; Duke, M. F., 1949.
Eberhardt, L. W., Asso. Director, Ga. Agric. Ext. Service, Athens, Ga.; Univ. of Ga., B.S.F., 1936.
Elliott, M. C., Inspector, Southern Pine Inspection Bureau, New Orleans, La.; Univ. of Ga., B.S.F., 1955.
McGurn, D. J., Forest Technician, International Paper Co., Maidson, Ga.; Univ. of Fla., B.S.F., 1950.
Todd, R. L., Dist. Forester, Rome Kraft Co., Centre, Ala.; Mich. College of Mining & Tech., B.S., (Forestry), 1951. (Affiliate 1954).

Member Grade

Allen, H. P., Dist. Forester, Ga. Forestry Comm., Newton, Ga. (Junior 1950).
Attaway, H. B., Director, State Forest Ranger School, Lake City, Fla. (Junior 1950).
Barnett, H. V., Asst. Reservation Forester, Post Engineers, Ft. Stewart, Ga.; Univ. of Fla., B.S.F., 1949. (Junior 1953).
Bumgarner, H. D., Resident Mgr., Natl. Turpentine & Pulpwood Corp., White Springs, Fla.; Univ. of Fla., B.S.F., 1949. (Junior 1950).
Burns, J. G., Field Service Representative, Hollingsworth & Whitney, York, Ala. (Junior 1950).
Calhoun, J. C., 1801 Car St., Palatka, Fla. (Junior 47R51).
Dexter, K. P., Conservation Forester, International Paper Co., Sheffield, Ala. (Junior 1950).
Elliott, R. H., 11 Lilian Place, Warrington, Fla. (Junior 1950).
Garrison, J. E. R., Forester, International Paper Co., Savannah, Ga. (Junior 1950).
Geiger, W. B., Forester, Union Bag Camp Paper Corp., Savannah, Ga. (Junior 1952).
Harper, J. P., Dist. Supv., International Paper, Co., Townsend, Ga. (Junior 1950).
Hoard, T. E., Unit Forester, International Paper Co., Panama City, Fla. (Junior 1950).
Hood, W. W., Farm Forester, Fla. Forest Service, Gainesville, Fla. Reinstatement.
Hughes, A. L., Dist. Supv., International Paper Co., Florala, Ala. (Junior 1950).
Jamerson, L. W., Unit Forester, International Paper Co., Lockhart, Ala. (Junior 1950).
Krul, P. F., Supv., Fla. Forest Service, Milton, Fla. (Junior 1950).
Mathews, J. R., Dist. Supv., International Paper Co., LaGrange, Ga. (Junior 1949).
Mikell, H. K., Asst. Chief Fire Control, Fla. Forest Service, Tallahassee, Fla. (Junior 1950).
Mobley, H. E., Forester, U.S.F.S., Centerville, Ala. (Junior 1950).
Owen, A. Z., Forester, U.S.F.S., Montgomery, Ala. (Junior 1950).
Parker, J. R., Instructor, Ga. Forest School, Athens, Ga. (Junior 1950).
Perdue, W. K., Area Supt., International Paper Co., Madison, Ga. (Junior 48R54).
Post, D. M., Instructor, Univ. of Fla., Gainesville, Fla. (Junior 1950).
Powers, L. M., Forester, Hudson Pulp & Paper Corp., DeLand, Fla. (Junior 1950).
Simmons, H. W., Consulting Forester & Land Mgr., Marianna, Fla. (Junior 1950).
Ward, J. R., Area Supt., International Paper Co., Madison, Fla. (Junior 1950).
Waters, W. V., Consulting Forester, Mt. Vernon, Ga. (Junior 45R54).
Woods, F. W., Forester, U.S.F.S., Marianna, Fla. (Junior 1950).

Associate Grade

Hyche, L. L., Asst. Entomologist, Ala.

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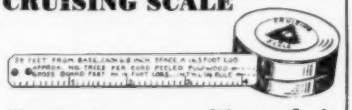

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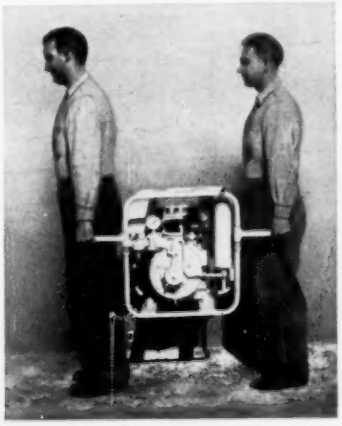

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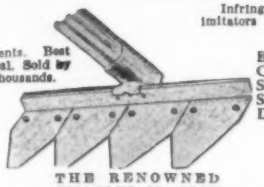
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Myhre, R. A.
Nicolls, W. R.
Nishanen, T. N.
Olafson, F. A.
Schneider, R. W.
Seastrom, D. P.
Shumway, C. A.
Wehergreen, J. W.

Junior Grade

Hansen, E. H., Dist. Ranger, U.S.F.S., Tofte, Minn; Iowa State, B.S.F., 1944.

Member Grade

Anderson, A. E., Forester, Kimberly Clark of Minn., Cook, Minn. (Junior 1950).

Barber, J. C., Research Asst., Univ. of Minn., St. Paul, Minn. (Junior 1950).

Batten, C. R., Forester, Northwestern Railroad, St. Paul, Minn. (Junior 1950).

Buckman, R. E., Forester, Lake States Forest Expt. Sta., Grand Rapids, Minn. (Junior 1950).

Coyer, M. A., Forester, Diamond Match Co., Grand Rapids, Minn. (Junior 1950).

Hammer, G. W., Forester, Minn. State Div. of Forestry, Baudette, Minn. (Junior 1950).

Hanses, E. H., Forester, Minn. Forest Service, Litchfield, Minn. (Junior 1950).

Irving, F. D., Instructor, Univ. of Minn., St. Paul, Minn. (Junior 1950).

Jamrock, E., Forester, Minn. State Div. of Forestry, Littlefork, Minn. (Junior 1950).

Johnson, A. R., Box 264, Littlefork, Minn. (Junior 1950).

LaMois, L. M., Forester, Lake States Forest Expt. Sta., St. Paul. Minn. (Junior 1950).

Nelson, L. O., Co-owner, Forestry Enterprises, Inc., St. Paul Minn. (Junior 1950).

Sandberg, D. L., Forester, Kimberly-Clark of Minn., Inc., Duluth, Minn. (Junior 1950).

Skok. R. A., Research Asst., Univ. of Minn., St. Paul, Minn. (Junior 1950).

Strothmann, R. O., Forester, Lake States Forest Expt. Sta., Grand Rapids, Minn. (Junior 1950).

Affiliate Grade

Peterson, M. J., Area Forester, State Cons. Comm., McGregor, Iowa.

Washington Section

Junior Grade

Totman, C. O., Colonel, U. S. Marine Corps, Washington, D. C.; Univ. of Maine, B.S.F., 1935.

Member Grade

Bailey, W. F., Research Forester, U.S.F.S., Beltsville, Md. (Junior 1950).

Enright, L. J., Prof., Univ. of Md., College Park, Md. (Junior 1950).

Mendel, J. J., Photo Interpretation Specialist, U.S.F.S., Washington, D. C. (Junior 43R55).

Prater, L. J., Information Specialist, U.S.F.S., Washington, D. C., (Junior 1950).

Associate Grade

Peterson, E. L., Asst. Secretary of Agric., U.S.D.A., Washington, D. C.

Wisconsin-Michigan Section

Junior Grade

Hagan, J., Area Supv., Consolidated Water Power & Paper Co., Summit Lake, Wis. Reinstatement.

Member Grade

Castonguay, M. I., Dist. Forester, Wis. Cons. Dept., Rhinelander, Wis. (Junior 1950).

Davis, C. N., Box 183, Solon Springs, Wis. (Junior 1950).

Jensen, E. P., Dist. Forester, Wis. Cons. Dept., Whitehall, Wis. (Junior 1950).

Miles, W. F, Pulpwood Buyer, Green Bay Pulp & Paper Co., Green Bay, Wis. (Junior 1950).

Redding, R. L., Dist. Forester, Wis. Cons. Dept., Mercer, Wis. (Junior 1950).

Reinke, M. E., Area Supv., Wis. Cons. Dept., Spooner, Wis. (Junior 1950).

Schultz, C. E., Asst. Dist. Forester, Wis. Cons. Dept., Hayward, Wis. (Junior 1949).

Tappon, M. T., Dist. Forester, Wis Cons. Dept., Jefferson, Wis. (Junior 1950).

Wallin, C. E., Log Buyer, Jackson Box Co., Solon Springs, Wis. (Junior 47R55).

Winner, L. B., Forest Mgr., U. S. Bureau of Indian Affairs, Shawano, Wis. (Junior 1950).

Affiliate Grade

Bell, H. C., Forestry Aide, Lake States Forest Expt. Sta., Wausau, Wis.

Associate Grade

Renlund, D. W., Supv., Wis. Cons. Dept. Madison, Wis.; Univ. of Minn., B.A., (Biology), 1950; Univ. of Neb., M.S., (Entomology), 1952.

Foreign

Junior Grade

Pellissier, D. H., U.S.S. Lafayette County, A.P.O., San Francisco, Calif.; State Univ. of N. Y., B.S.F., 1953.

Corresponding Member

Muelder, D., Prof. of Forestry, Univ. of Gottingen, Germany.

Richard, F., Forest Soil Research, Swiss Forest Expt. Sta., Zurich, Switzerland.

RuizLanda, E., Prof. of Forestry, Facultad de Agronomia e Instituto Forestal, Universidad Nacional, Colombia, South America; Univ. of Mich., M.F., 1946.

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Maquire, J. H., Stockton Fld. Annex, Lathrup, Calif.; Pa. State, B.S.F., 1954.

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Forestry News

1955 Annual Report of Forest Service Released

Release of the 1955 annual report of the Chief of the Forest Service to the Secretary of Agriculture was announced November 30 by the Department. The report presents a summary of the record breaking use of national forest resources and developments of significance to the Forest Service in its Golden Anniversary year.

Annual reports of the Forest Service were discontinued in 1953 on a trial basis but have been resumed due to interest shown by national forest users and the general public.

Although Richard E. McArdle, Chief of the Forest Service, reported mainly on the work done, he pointed out in the report's foreword that the multiple-use principle of management of the national forests was thoroughly tested. "The mounting needs for water, timber, and forage, for recreation, for wilderness areas, and for hunting and fishing test our skill in both resource management and human relations."

The year 1955 was a record breaking one for the national forests, according to the report. Timber cut reached a new high of 6.33 billion board feet. More than 45 million recreation visits were made to the national forests. Total receipts from sale and use of all national forest resources hit a record high of $77,664,667.

In its work with the states, the Forest Service helped in protecting 387 million acres of nonfederal forest land from fire, in providing technical assistance to 35,000 forest landowners, in controlling blister rust on 827,000 acres of land, in producing 519 million tree seedlings in 90 state nurseries, and in planting 704,000 acres to trees.

Forest Service research covered a variety of fields from control of mass fires to control of timber rot in houses without basements. A fiberboard that gives protection against all known chemical and biological warfare agents, and to some degree from radiological agents, was developed. A new experimental center was set up in the Hubbard Brook area in the White Mountains of New Hampshire to study water runoff, at the source, rivers.

Dr. McArdle mentioned specially in his report two of the 31 Congressional acts since 1953 which applied to the Forest Service. The general mining laws were amended to give the Forest Service management of the surface resources on a national forest claim until it goes to patent. A land exchange between the Departments of Agriculture and Interior eliminating intermingled administration of about 484,000 acres of forest land in southwestern Oregon was completed under legislative authority.

A preliminary report on a three-year survey of the country's timber resources and a look into future needs and supplies was completed by the

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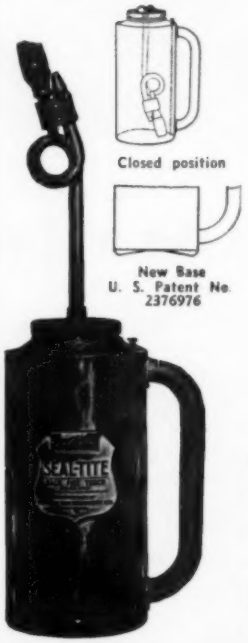

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Forest Service with the collaboration of state agencies, forestry schools, and forest industries. Rehabilitation and improved management was continued on land utilization projects transferred from the Soil Conservation Service to the Forest Service in 1954. Resources from these lands brought in a total of $1,618,410. Smokey Bear, under sponsorship of the Forest Service, the state foresters, and the Advertising Council, continued to help reduce the number of man-caused forest fires.

A limited supply of copies of the report is available. Copies may be obtained from the Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

Hunting and Fishing Are Big Business

The first nation-wide survey of hunting and fishing revenues has been made by Crossley, S-D Survey, Inc., of New York, on behalf of the U. S. Department of the Interior. The survey discloses that twenty-five million sportsmen in 1955 spent nearly $3 billion for 500 million days of this sport, and drove automobiles 10.4 billion miles in pursuit of it. Individuals fishing in 1955 totaled 20,813,000 persons, with a total expenditure of $1,914,292,000 for both salt and fresh water fishing. There were 11,784,000 hunters in 1955, with a total expenditure of $936,687,000. The statistics show that 21.2 percent of the population either hunted or fished or did both; 17.6 percent fished; 10 percent hunted. In the big cities, 10 percent were fishermen and 6 percent hunters; in rural areas, 21 percent were fishermen and 16 percent were hunters. In rural areas, every other household had at least one fisherman or hunter.

Work-Study Program Available to Forestry Students

The U. S. Civil Service Commission has an examination for Student Trainee (Forestry), for filling positions paying $3,175 and $3,415 a year in the Bureau of Indian Affairs and the Bureau of Land Management of the Department of the Interior, and the Forest Service of the Department of Agriculture. Positions are located throughout the United States and in Alaska.

Applicants must pass a written test and, in addition, have completed or be currently enrolled in at least the first year of a 4-year college course leading to a bachelor's degree in forestry. Employment will be for summer vacation periods of regular full-time colleges, or during work-experience periods provided for in colleges operating on a cooperative basis. Applications will be accepted until further notice. Instructions on how to file applications are given in civil service Announcement No. 90 B.

Further information and application forms may be obtained from many post offices throughout the country or from the U. S. Civil Service Comission, Washington 25, D. C.

State Game and Fish Experts Meet with Forest Service Officials

Representatives of state game and fish departments and wildlife specialists of the U. S. Forest Service discussed public demand for more hunting and fishing, among other subjects, at a meeting in Washington, D. C., December 4. Representatives of the International Association of Game, Fish and Conservation Commissioners participated in the meeting.

The group reviewed plans for cooperative projects to improve wildlife habitat in the national forests and discussed other ways of meeting the demands for more hunting and fishing.

Participants in the conference also discussed harvesting the surpluses of big game in remote and inaccessible areas of the national forests. In addition they considered what could be done to protect wildlife in areas where reclamation projects are being developed in national forests.

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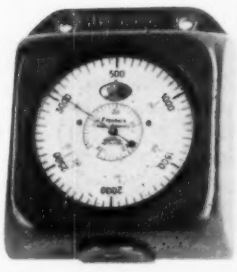

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Thailand Host to Pacific Science Congress

The Ninth Pacific Science Congress will be held on the campus of Chulalongkorn University, Bangkok, Thailand, November 18 to December 9, 1957. The Congress will be held under the auspices of the Government of Thailand and the Science Society of Thailand.

Individuals wishing further information on this meeting may write the Pacific Science Board, National Research Council, 2101 Constitution Ave., Washington 25, D. C.

Paper Mill Wastes Eyed As Livestock Feed

Waste sulfite liquors from paper mills may in the future be processed into a useful livestock feed supplement instead of creating a troublesome stream pollution problem according to engineers at Oregon State College who have reported a process for treating the spent liquors to make a protein concentrate. Preliminary studies indicate it "would be a satisfactory supplement in rations of livestock."

However, research workers hasten to point out that the new process is still in the development stage and a number of questions remain to be answered before it can be used in industry. Costs of plant installation might also be prohibitive to smaller firms.

The treatment involves use of a bacterial culture to ferment the spent liquors. The resulting product contains a high percentage of protein.

The National Council for Stream Improvement, composed of pulp, paper and paperboard industries, furnished financial support for the research study.

A report of the study is available from the Engineering Experiment Station at Oregon State College, Corvallis.

N. H. Forester Elected to Legislature

Robert S. Monahan, Hanover, N. H., has been elected to the New Hampshire House of Representatives. Monahan is college forester and manager of outing properties for Dartmouth College.

He has been appointed ranking majority member of the Committee on Recreation, Resources and Development.

North American Wildlife Conference

The 22nd North American Wildlife Conference, sponsored by the Wildlife Management Institute, will be held on March 4-6, 1957, in the Statler Hotel, Washington, D. C.

Built around the general theme, "Conservation in Everyone's Business," are three general and six technical sessions covering many phases of soil, water, wildlife, and forest management and restoration. Nearly 60 speakers will focus attention on natural resource issues as well as on the latest research findings and management developments.

W. Va. Recognizes Professional Consulting Work for Tax Purposes

The West Virginia State Tax Commissioner has recently recognized for purposes of Business and Occupation Tax liability that the activities of a consulting forester should be treated as professional and are not therefore subject to the tax. Professional activities, requiring professional judgement and application, were differentiated from those of a "service" nature, such as the selling of chain saws, which are subject to the tax.

Education

API Program to Aid Southern Nursery Production

The Alabama Polytechnic Institute Agriculture Experiment Station has entered into an agreement with ten southern states and the U. S. Forest Service to provide technical assistance and to test soils for state-owned tree nurseries in an effort to boost seedling production under the Conservation Reserve phase of the Soil Bank Program.

The assistance program's goal in 1957 is to increase tree seedling production by 200 to 300 million in the ten states.

A 5-year research program in nursery management at the API Station has greatly expanded seedling production in the state-owned Auburn Nursery without increasing acreage.

State agencies entering into the agreement are the Arkansas State Forestry Commission, Florida Forest Service, Georgia Forestry Commision, Louisiana Forestry Commission, Mississippi Forestry Commission, Oklahoma Division of Forestry, South Carolina State Commission of For-

estry, Tennessee Division of Forestry, Texas Forest Service, and Alabama Division of Forestry.

Jack T. May, forester of the API Agricultural Experiment Station, will serve as technical leader and A. R. Gilmore, assistant forester, will be in charge of nursery soil testing.

N. Y. Faculty Member to UN Post

John M. Yavorsky, associate professor of forest utilization at the State University College of Forestry at Syracuse University, resigned his position in December to accept a post in Rome, Italy with the United Nations. He has become chief of the Forest Utilization Section of the Forestry Division, Food and Agriculture Organization of the United Nations. The International headquarters of FAO is in Rome.

In his new position Yavorsky will be responsible for coordination of the UN's technical assistance program in the field of forest products utilization. He will also assist in implementing FAO's program in forest utilization through technical conferences on utilization and the exchange of knowledge by international authorities in this field.

JOHN M. YAVORSKY

Yavorsky has been at the College for the past eight years in research and teaching in the engineering aspects of wood utilization. He spent four years in military service in World War II and was discharged with the rank of captain in the Army Air Force. He was awarded his Ph.D. in 1955 by the College of Forestry.

Shirley Honored For Contributions to International Forestry

Dr. Hardy L. Shirley, dean of the State University College of Forestry at Syracuse University, has been designated to receive a certificate of honorary membership in an international professional forestry organization—the Society of Finnish Foresters.

The award has been presented to Dean Shirley for his "outstanding contributions to the field of international forestry."

Dean Shirley is currently a member of the United Nations Food and Agriculture Organization's Panel on Education in Forestry. He has long been active in international forestry circles. During the past summer he spent a total of 12 weeks visiting forestry leaders and forestry schools and universities in six western European countries. In addition, he attended an international symposium which was held at Oxford University, England, during last July.

In 1949, Dean Shirley attended the Third World Forestry Congress which

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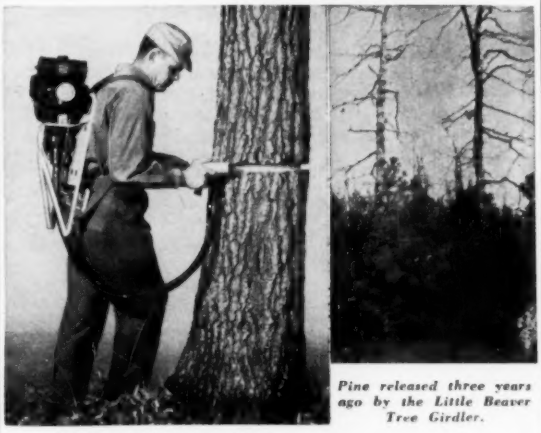

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was held in Helsinki, Finland, and in 1954, the Fourth World Forestry Congress, held in Dehra Dun, India.

Throughout his forestry career, he has maintained a constant interest in world happenings in forestry. He has participated in many international forestry meetings and has held office and committee assignments.

First Chapman Foundation Scholarships Awarded

The awarding of the first "Chapman Foundation Scholarships for Freshman Foresters" was announced in October by Frank H. Kaufert, director of the University of Minnesota School of Forestry. Two awards of $300 each will be awarded annually at that institution.

Students Harry R. Nickless and Richard L. Rislund were selected to receive the scholarship awards. Winners of the scholarships are selected on a basis of academic aptitude, vocational promise, character, leadership, and financial need.

Funds for the scholarships were granted by the Chapman Foundation of Memphis, Tenn. This foundation is supported by the Chapman Chemical Company. Its president, A. Dale Chapman, established the scholarships to encourage qualified students to prepare for careers in forestry.

Penn State to Hold Lumber Grading Short Course

The School of Forestry of The Pennsylvania State University is offering a short course in grading of hardwood lumber. This is the fifth annual short course on hardwood lumber grading.

The dates are from March 11 to March 15, 1957. Enrollment will be limited and requests will be considered as they are received. The work will cover all the problems in grading and inspection of native hardwoods. Considerations of thickness, measurement, manufacture, and other questions from the class will be answered.

Enrollment can be made by obtaining a registration form from the:

Director of Short Courses
College of Agriculture
The Pennsylvania State University
University Park, Pa.

If additional information is desired, write to:

Orvel A. Schmidt
School of Forestry
The Pennsylvania State University
University Park, Pa.

New Forestry Curriculum at Colombia National University

Wayne W. Gaskins, a U. S. forester assigned to the National University at Medellin, Colombia, reports that a new program of forestry study has been started in the University's Instituto Forestal.

On completion of the five-year curriculum in forestry the graduates receive the degree *Ingeniero Forestal*. Students who do not wish to study for five years receive training in a two-year program of study plus a field training camp.

Mr. Gaskins is serving as one of the professors of forestry at the school.

LSU Forestry School to Sponsor Sixth Symposium

Louisiana State University's School of Forestry will sponsor its Sixth Annual Forestry Symposium on the campus April 4 and 5, 1957, it was announced by Professor William C. Hopkins, general chairman of the conference.

The general theme of the symposium will be "Special Problems in Southern Forestry." Some 400 foresters, a number equal to last year's attendance, are expected for the event.

Plans call for three half-day sessions devoted to problems in three areas: forest and game; range and recreation; and insect and disease.

Inquiries about the symposium may be addressed to Professor Hopkins, LSU School of Forestry, Baton Rouge, La.

Private & Industrial

J. P. Weyerhaeuser, Jr., Dies

John Philip Weyerhaeuser, Jr., died December 8 at Tacoma, Wash., after a sudden and severe intensification of leukemia. He was 57 years old.

The prominent lumberman had served as president of Weyerhaeuser Timber Company since 1947 and was executive vice president from 1933 to 1947.

Born in Rock Island, Ill., January 18, 1899, he attended the Hill School in Pottstown, Pa. and in 1920 received an A.B. degree at Yale University.

Mr. Weyerhaeuser started his career in the lumber industry in 1921 with Edward Rutledge Timber Company of Coeur d'Alene, Idaho. In 1922 he became sales manager of that company. He became general manager of Clearwater Timber Company in 1925 and held that position until 1931, when he became president of Potlatch Forests, Inc., Lewiston, Idaho. His appointment as executive vice president of the Weyerhaeuser Timber Company was made in 1933, followed by advancement to president in 1947.

Mr. Weyerhaeuser was elected president of American Forest Products Industries, Inc. in November. He was delegate to the Timber Committee, Food and Agricultural Organization of the United Nations, Geneva in 1955. In the same year he received the Distinguished Service Award in Forestry from the American Forestry Association.

He served as a field artillery 2nd lieutenant during World War I.

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Used extensively by experts. Heavy-duty 30" Pruner (1¼" capacity) with compound lever action for fast, easy cutting. Side-cutting head leaves clean wounds, PLUS fast-cutting curved blade Pole Saw. Octagon spruce poles fit both heads. Two sections, intermediate and bottom, furnished. With 4' sections, $28.30; 6', $32.70; 8', $34.60 delivered in U.S.A.

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McCulloch Motors Aids Tree Farm Program

A new over-the-counter information service for increasing interest in tree farming is being inaugurated by McCulloch Motors Corp.

Through its several thousand dealers across the country, McCulloch is distributing free literature on the American Tree Farm System, according to C. A. Gillett of Washington, D. C., managing director of American Forest Products Industries, Inc., national sponsor of the system.

The literature explains the basic objectives of the Tree Farm System and tells landowners how to make application to their local Tree Farm committees for technical forestry help and Tree Farm certification.

C. Fred Breer, McCulloch vice-president, said the action was taken to "lend our assistance to the forces of conservation and good forestry in America."

M. F. Hamm Joins Consulting Firm

Maurice F. Hamm, formerly assistant district forest of the Tennessee Division of Forestry has become associated with the Southern Timber Management Service. This is a consulting forestry firm of Birmingham, Ala.

Hamm will be manager of the branch office of the firm at McComb, Miss., where he will supervise management of timberlands under contract and related activities. He is a forestry graduate of Louisiana State University.

Bodine Elected Vice President Diamond Match

Election of Leo V. Bodine as vice president in charge of timber and lumber operations of The Diamond Match Company was announced in January by Robert G. Fairburn, president.

His initial responsibilities will include supervision of Diamond's Northwest Lumber Division which operates properties in Idaho, Montana, and Washington. He will make his headquarters in Spokane.

Mr. Bodine has served since May, 1952 as executive vice president of the National Lumber Manufacturers Association in Washington, D. C., as well as chairman of the board of the Timber Engineering Company, NLMA's research affiliate.

Prior to assuming his duties with the NLMA, he was vice president of

LEO V. BODINE

Weyerhaeuser Sales Co., St. Paul, Minn., in charge of public relations.

A native of Elberton, Wash., he began his career in the forest products industry with Clearwater Lumber Company, Lewiston, Idaho, in 1929. Two years later he joined Potlatch Forests, Inc., where he held various positions in sales, manufacturing, distribution, and public relations.

Allied

Flanagan Heads Western Forestry

George C. Flanagan, Elk Lumber Co., Medford, Ore. was elected president of the Western Forestry and Conservation Association at its 47th annual meeting December 5-7 in Victoria, B. C. Flanagan, who served as first vice president during the past year, succeeds John E. Liersch, Vancouver, B. C.

Florida Forestry Groups Meet

The Florida Forestry Council met in Lake City November 29 and reviewed a long range forestry program for the state which has been under study for a year. Four segments of the plan, covering protection, management, research, and education are being prepared for publication. The following officers were re-elected: chairman, Donald Stevenson, Buckeye Cellulose Corp.; vice chairman, L. S. Newcomb, U. S. Forest Service; and secretary-treasurer, Charles G. Geltz, School of Forestry, University of Florida.

The Florida Forestry Association, meeting in Gainesville on December 12,

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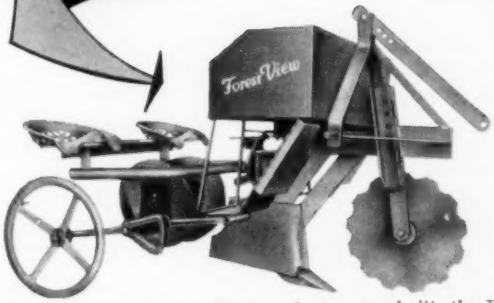

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re-elected Justin R. Weddell president and Charles Soule, Norman Herren, Donald Stevenson, and W. W. Shands vice presidents; Charles G. Geltz continues as secretary and G. G. Ware as treasurer. The association, together with the Governor's Committee on Forest Fires is sponsoring a series of three forest fire meetings to be held throughout the state during the current fire season. Among other business the Association endorsed State Forester C. H. Coulter's biennium budget request and sought to strengthen appropriations for law enforcement and extension of fire protection.

Public

H. A. Harrison Promotion Announced

Promotion of Henry A. Harrison to assistant chief, Division of Recreation and Lands, in the Washington, D. C. office of the U. S. Forest Service has been announced.

Forest supervisor in charge of the Mt. Baker National Forest in northern Washington since May 31, 1953, Harrison replaces John Herbert.

JOHN VON BARGEN

Harrison began his forestry career in 1933 as a CCC enrollee, on the Colville National Forest in Washington. He graduated from the University of Washington in 1935 with a B.S. degree in forestry and was appointed as forester in the same year, doing duty on the Okanogan and Mt. Baker National Forests. He was transferred in 1936 to become assistant ranger on the Naches District of the Snoqualmie Forest. A year later he became district ranger in charge of the Sumpter District, Whitman National Forest. He was also district ranger on the Walla Walla District of the Umatilla National Forest from 1941 to 1943.

Following service from 1943 to 1946 as a Naval officer, Harrison returned to a district ranger position on the Union District of the Whitman Forest. This was followed by promotion to a staff position in charge of engineering and fire control work later that year. From 1950 to 1953 he served as assistant forest supervisor of the Snoqualmie National Forest with headquarters in Seattle.

New Forest Supervisor Selected for the Chippewa

John Von Bargen has been named the new forest supervisor of the Chippewa National Forest in northern Minnesota. This was announced by Arthur W. Greeley, regional forester of the North Central Region of the Forest Service. Von Bargen replaces Dan Bulfer who was recently promoted to a personnel position in the Washington office of the Service.

Von Bargen obtained his forestry education at the University of Idaho and received the first regular appointment with the Forest Service on the Chippewa in June 1935. He served for a while as a junior forester before going to the Ottawa national forest (Michigan). There he was successively district forest ranger and timber management staff assistant. In 1945 he returned to the Chippewa in charge of timber management activities. In 1949 he was transferred to the Clark (Missouri) National Forest as assistant supervisor and in 1951 was promoted to the regional office of the North Central in Milwaukee where he had a number of assignments including work in cooperative federal-state forestry, timber management, and general administration duties.

R. B. McKennan Promoted To Washington Position

Russell B. McKennan, Denver, Colo., assistant regional forester for the Rocky Mountain Region of the U. S. Forest Service, has been promoted and transferred to a position as inspector in the chief forester's office in Washington, D. C. His move was effective December 30.

A forestry graduate from Iowa State College at Ames, McKennan has been a career employee of the Forest Service since 1924.

After a period as forest assistant on the Black Hills National Forest in South Dakota, McKennan transferred to the Lake States Region where he served as forest ranger and forest supervisor on various national forests. He returned to the Rocky Mountain Region in 1945 and was supervisor of the Pike National Forest from 1946 to 1952.

In 1952, he was promoted to regional head of personnel manage-

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"We applied SUNOX in a test for control of pre-emergence damping-off on both black and white spruce. Damping-off killed 75% of the seedlings in the control bed, 50% in the recommended treatment and less than 10% in double the recommended measure," reported a large grower in the Mid-west.

"A marked reduction in the mortality of the small trees was noticed immediately after application of SUNOX," another large grower in the South reported. "We made three applications on the affected areas with significantly good results."

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Large, old, well-established wholesale mail order forest tree nursery with excellent reputation doing nation-wide business, specializing in Christmas tree planting stock and ornamental lining out material. Two modern homes (one small), office, a number of other buildings, including modern cold storage. Best new construction. Abundance pure water. Irrigation, equipment, shading material. Inventory of 7 to 8 million seedlings and transplants. Annual sales over $100,000. Can be increased to $200,000. Beautiful location near churches and schools, college town in western Pennsylvania. Exceptional investment opportunity for one or two younger men. Reason for selling poor health. Only financially responsible persons considered.

Send replies to Box D, Journal of Forestry, Mills Building, Washington 6, D. C.

ment in the Forest Service Denver office and was later assigned to head the Division of Recreation, Lands, and Watershed Management.

Virginia State Forester Honored

George W. Dean, state forester of Virginia, has been named "Man of the Year in Service to Virginia Agriculture" by the *Progressive Farmer*, southern agricultural periodical, for his outstanding leadership in forest conservation. Virginia's forest management assistance program, outstanding record in fire prevention and suppression, and tree planting attainments were cited.

Prior to his appointment as state forester in 1944, Dean served as chief of forest management and as district forester in the state Division of Forestry, Department of Conservation and Development.

Paul Hickie Leaves Interior Post

Dr. Paul F. Hickie has resigned from the U. S. Fish and Wildlife Service, Department of the Interior, Washington, D. C., to enter private business in Stephenville, Texas. At the time of his resignation Hickie was serving as acting chief of the Branch of Wildlife Research. Previously he had been stationed at the Denver Research Laboratory.

Augsbach Named Bighorn Forest Supervisor

William E. Augsbach, acting supervisor of the Bighorn National Forest with headquarters at Sheridan, Wyo., has been named the new Bighorn Forest supervisor according to regional forester Donald E. Clark.

ARTHUR G. NORD

Augsbach is a forestry graduate of the Michigan State University. He moved from a ranger position at Dubois, Wyo., to staff assistant on the Bighorn Forest in March 1956. Previous to his assignment as ranger at Dubois on the Shoshone National Forest, he served as forest technician and ranger on several forests in Colorado and Wyoming.

Sierra Forest Supervisor Promoted

Leon R. Thomas, supervisor of Sierra National Forest, Fresno, Calif. has been promoted and transferred to the position of assistant regional forester in charge of Fire Control for the U. S. Forest Service Southern Region, with headquarters in Atlanta, Ga. His move became effective in January.

Thomas is a 1936 forestry graduate of the University of California. He received his first appointment with the Forest Service as a Junior Forester in 1937, entered military service in 1942, and was discharged with the rank of captain in 1946. On return to the Forest Service he served as district ranger on three different districts from 1942 to 1948, was promoted to fire control staff position on the Sequoia National Forest and later to assistant supervisor on the same forest. He became supervisor of the Mendocino National Forest in 1951 and supervisor of the Sierra National Forest in July 1954.

Forest Service Veteran To Retire

Arthur G. Nord, veteran of 41 years in the U. S. Forest Service, retired December 31. From the position of assistant regional forester in charge of the Division of Lands, Recreation, and Watershed Management for the Intermountain Region. He had held this position since 1940.

A native of Rigby, Idaho, Nord joined the Forest Service as forest guard in 1915. He became a forest ranger on the Targhee National Forest, Idaho, in 1916. He served with the U. S. Army in France as a forest engineer from 1917 to July 1919.

After returning from military service he became ranger on the Targhee National Forest and was made assistant forest supervisor of the Bridger National Forest, Wyo., in 1923.

He served successively as forest supervisor on the Ashley, Wasatch, Challis, and Cache National Forests from 1925 until 1940, except for a short two-year assignment as assistant regional forester at Milwaukee, Wis., from 1934 to 1936.

Nord has been a leading exponent for flood control and watershed res-

NEW SOCIETY PUBLICATION AVAILABLE

Forest Practices Developments in the United States, 1940-1955

Report of the Committee of Forest Practices, Division of Silviculture, Society of American Foresters, Kenneth P. Davis, *Chairman*.
The report is in three parts: (1) highlights of major developments affecting forest practices during 1940-1955, (2) digest and summary of present state legislation on cutting practices, and (3) annotated bibliography with a key to 1940-1955 literature.

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INDEX TO ADVERTISERS

	Page
Atkinson, S. Gayley	159
Banzhaf & Co., George	158
Bartlett Mfg. Co.	172
Belanger & Bourget	158
Bozett, Wm. J.	159
Bruns, Paul	166
Caterpillar Tractor	Third Cover
Chain Saw Age	170
Clark, Thomas G.	159
Clifton, Thomas C.	159
Cranston, Keith	158
Dow Chemical Co.	167
Eastman, Jr., William A.	159
Fechheimer Bros., Co.	166
Forest Seeds of Calif	166
Forestry Suppliers	157
Forestview Evergreen Nurseries	173
Hale Fire Pump	165
Hall, Albert G.	159
Hall, Jack M.	159
Hammon, Jensen & Wallen	158
Haynes Mfg. Co.	171
Hazard, J. O.	163
Homelite Corp.	Back Cover
International Harvester	98
Keene Forestry Assoc.	159
Kurfew, Inc.	165
Lemieux, Frank	159
Lind Co., A. L.	163
Lowther Co., Harry A.	170
Lufkin Rule Co.	168
Meadows, Ben	160
Melin Meterological Service	172
Midvale Chemical Co.	174
Missoula White Pine	164
Musser Forests, Inc.	175
Nelson Co.	156
Northeast Forestry Service	159
Northern Tree Co.	159
Osmose Wood Preserving	171
Paint Creek Nurseries	170
Pomeroy & McGowin	158
Pond & Moyer	159
Prentiss & Carlisle, Inc.	159
Price, William H.	159
Rich Fire Tool	166
Ronald Press Co.	161
Rootspred	169
Ryker, Inc., Harrison C.	172
Sebrell Corp., J. B.	163
Sewall Co., J. W.	159
Smith Co., D. B:	Second Cover
Southern Coatings	162
Southern Seed Co.	163
Southern Timber Mgmt.	158
Stock, John W.	159
Sunerest Evergreen	164
Timber Mgmt. Service	159
Tree Farm Mgmt. Service	159
Western Fire Equipment	168
Winslow, Paul T.	159
Wolff, William	169
Woodlot Seed	170

toration in the Intermountain Region and pioneered in cooperative watershed improvement programs. He is a member of the SAF, the Utah Academy of Sciences and the Wilderness Society.

Advisory Task Group Named to Study Increased Use of Forest Products

Appointment of a Task Group on Forest Products, to advise the President's bipartisan Commission on Increased Industrial Use of Agricultural Products, has been announced by Commission Chairman J. Leroy Welsh, of Omaha, Neb.

Chairman of the 8-member task group is Paul M. Dunn, St. Regis Paper Company, New York, N. Y. The group's first meeting was in December.

This advisory group is to review the technical and economic position of forest products, and appraise current and planned research on their utilization. An advisory report of the group's findings will be submitted for consideration by the Commission in making recommendations to Congress aimed to increase industrial uses for farm products.

Members of the task group, in addition to Chairman Dunn, are: Harley Langdale, Jr., vice president, Langdale Company, Valdosta, Ga.; Clark C. Heritage, consulting engineer, Tacoma, Wash.; Dr. J. A. Hall, director, Forest Products Laboratory, U. S. Department of Agriculture, Madison, Wis.; Dr. E. S. Harrar, acting dean, Duke University's School of Forestry; Harold Evans, director of research, Douglas Fir Plywood Foundation, Tacoma, Wash.; Ralph M. Bescher, assistant to general manager, Wood Preserving Division, Koppers Company, Pittsburg, Pa.; S. M. Nickey, Jr., vice president, Nickey Brothers Inc., Memphis, Tenn.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Positions Wanted

Forester, graduate Prussia State School of Forestry, 20 years experience in German forest and game management. Married, three children. Speaks English, German, French. Will accept assignment Alaska or any state.
Hubert Stipa, 508 Marshall, Jefferson City, Missouri.

Graduating in May with B. S., in Forest Management, North Carolina State College. Age 26, married, no children, veteran. Desire position in forest tree nursery or in research work. Will consider any locality. Have had one summer's work experience in Southern tree nursery. Capable, aggressive worker.
Box H, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, BSF MF 1948 University of Georgia. Experience in Forest Management, Wood Procurement, Logging and Research.
Box I, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1951. Age 31. Married, with Family. Currently head of Timber Division of medium-sized plywood operation. Experienced in all phases of cruising, timber appraisal and acquisition, supervision of contract logging, engineering, and log buying. Desires position on West Coast with timber division of an aggressive, stable concern.
Box J, Journal of Forestry, Mills Building, Washington 6, D. C.

Labor Official Heads Washington Forest Products Commission

Earl Nimz of Spokane, president of Inland Empire District Council No. 10, International Woodworkers of America, was recently elected vice-chairman of Washington State's Forest Products Commission.

The selection of Nimz by the commissioners filled a vacancy caused by the death of Elias T. Clark on June 1. Nimz has served as a Forest Products Commissioner since the Commission was established by the state legislature in 1947.

The Governor is chairman of the Commission, and the vice-chairman presides at Commission meetings which the Governor is unable to attend.

The commissioners, who govern activities of Washington State's Institute of Forest Products, adopted an ambitious program to be followed by that forest research organization for the next two years. Outstanding projects authorized include a two-year study of sawdust and bark utilization for soil conditioning, and a reconnaissance of the state's hardwood timber resources. The Institute also was instructed to gather current statistics on pulpwood supply and use, and to publish that information promptly.

The Institute's technical director, Gordon D. Marckworth, was authorized to compile complete statistical data on the state's forest resources for immediate publication and state-wide distribution.

This D4 piles slash from a daily cut of 50,000 bd. ft.

The White Swan Lumber Co., White Swan, Washington, uses this CAT* D4 Tractor with Fleco Root Rake in its selective logging operation on the Yakima Indian Reservation. The D4 piles slash from a daily cut of 50,000 bd. ft. It works an 8-hour day, 5 days a week. The company bought it for several reasons. Among them: the excellent reputation of the nearby Caterpillar Dealer for service and the excellent reputation of Caterpillar-built equipment for dependable performance under difficult conditions. Robert Turner, White Swan's superintendent, says: "We're very well satisfied with our D4."

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This Lightweight Chain Saw Packs Real Power

The Homelite 5-20 — with 5 full horsepower and easy-to-handle 20 pounds — fells, bucks, notches and limbs with less effort and in less time. It brings down trees up to 6 feet in diameter — cuts through 20 inch trees in 20 seconds. And because of its diaphragm carburetor and positive fuel pump, the 5-20 lets you cut from all angles, in any position — with no adjustment or loss of power.

Besides its rugged power, light weight and ease of handling, the 5-20 assures you quick starting in *any* weather . . . low maintenance costs in *any* cutting operation. And in addition to its wide range of straight blades and plunge-cut bows for all types of production cutting, the 5-20 can be converted to a brush cutter for clearing fire lanes in pulpwood or timber tracts. A special clearing attachment is also available for speedier, easier limbing or for clearing out small trees.

Your Homelite dealer will be glad to give you a free demonstration of this power-packed, value-packed 5-20. See him soon.

Homelite builds and sells more chain saws than any other company in the world

A COMPLETE LINE OF CHAIN SAWS FOR EVERY CUTTING JOB

Model EZ . . . lightest, most powerful direct drive chain saw ever developed. Only 19 pounds, full 5 horsepower. Brings down trees up to 3 feet in diameter.

Model 17 . . . an all-purpose saw that brings down trees up to 4 feet in diameter. Available with special brush cutting, bow and clearing attachments for complete versatility. 3½ horsepower, 20 pounds.

Model 7-29 . . . the most powerful one man chain saw you can own. Seven full horsepower, only 29 pounds. Power to give top production in the biggest timber, yet light enough for work in the smallest trees. Cuts down trees up to 10 feet in diameter. Available with straight blades or plunge-cut bows.

HOMELITE

A DIVISION OF TEXTRON INC.

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In Canada: Terry Machinery Co., Ltd.

Manufacturers of Carryable Pumps • Generators Blowers • Chain Saws